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EIP Associates

Supplemental Draft
Environmental Impact Report/Statement II

Monterey Peninsula Water Supply Project

VOLUME I

Monterey Peninsula Water Management District

U.S. Army Corps of Engineers
Permit Application #16516 S09
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The Monterey Peninsula Water Management District (MPWMD) has examined 5 alternatives with the basic project purpose of providonga minicipal water supply to the Monterey Peninsula that would provide adequate drought protection for existing residents and meet the long term water supply needs of planned growth. The overall project purpose is to provide adequate instream flow to protect the public trust resources of the Carmel River. The 5 alternaitves studied are: a 24,000 AF New Los Padres Reservoir, either alone or combined with a 3 MGD desalination plant; a 15,000 AF Canada Reservoir&3 MGD Desal Plant; a 7 MGD desal Plant; and No project.

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ERRATA SHEET

SUPPLEMENTAL DRAFT EIR/EIS-II FOR THE
MPWMD LONG-TERM WATER SUPPLY PROJECT
U.S. Army Corps of Engineers, Permit Application #16516 S09
SCH #87092203

February 25, 1993

Please note the following corrections and clarifications for the Supplemental Draft EIR/EIS-II for the long-term Water Supply Project:

SUMMARY, page S-44, first full paragraph:

In line 5, insert the word "may" after the word "either".

In line 7, replace the words "other significant adverse environmental consequences" with the words "meeting the overall project purpose." Delete the quotation marks in the sentence.

SUMMARY, page S-47, second full paragraph:

In line 4, replace the words "Final SD EIR/EIS-II" with the words "Final EIR/EIS".

CHAPTER 1, page 1-7, paragraph 2:

In line 6, replace the words "prior to" with the word "after".

CHAPTER 2, page 2-7, paragraph 2:

In line 5, replace the word "Because" with the words "As long as".

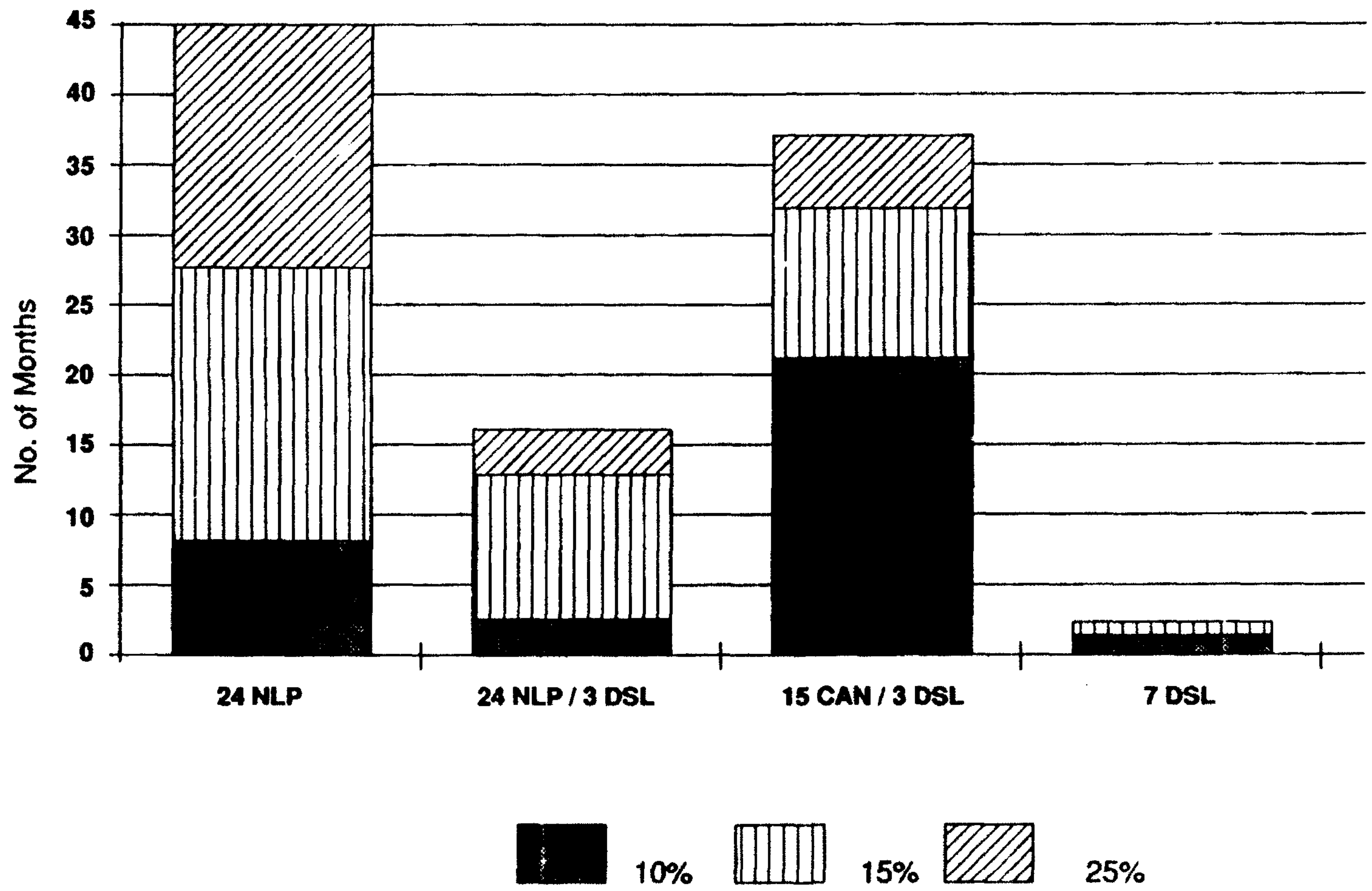
In line 6, replace the word "supplies" with the words "supply facilities".

CHAPTER 5, page 5-15; Figure 5-4:

The figure legend is incorrectly labelled. The dark shaded area should be labelled 10% rationing, not 25% rationing. The diagonal stripes should be labelled 25% rationing, not 10% rationing. See attached replacement page.

SEVERITY OF RATIONING IN TWO DROUGHT EVENTS AT BUILDOUT
(1977-78 AND 1989-91 COMBINED)

FIGURE 5-4



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SUPPLEMENTAL DRAFT-II ENVIRONMENTAL IMPACT REPORT/ ENVIRONMENTAL IMPACT STATEMENT

MONTEREY PENINSULA WATER SUPPLY PROJECT MONTEREY COUNTY, CALIFORNIA

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Abstract:

The Monterey Peninsula Water Management District (MPWMD) has examined five alternatives with the basic project purpose of providing a municipal water supply to the Monterey Peninsula that would provide adequate drought protection for existing residents and meet the long-term water supply needs of planned growth. The overall project purpose is to provide adequate instream flow to protect the public trust resources of the Carmel River. This Supplemental Draft EIR/EIS-II examines the environmental consequences of the five alternatives, which include: a 24,000 AF New Los Padres Reservoir, either alone or combined with a 3 MGD desalination plant; a 15,000 AF Cañada Reservoir (offstream site) combined with a 3 MGD desalination plant; a 7 MGD desalination project comprised of two plants constructed in two phases; and the No Project alternative.

Review Period:

This Draft EIR/EIS will now undergo a public review period that lasts for 45 days following the notice of this document in the Federal Register on March 12, 1993. Written comments must be submitted to either of the designated lead agency contacts by April 26, 1993. Oral and written comments on this document may also be presented at the MPWMD's public hearings, scheduled for Thursday, April 22 (3:30 and 7:30 PM) at the Monterey City Council Chambers. In addition, three public workshops will be held – on Wednesday, April 7 (3:30 and 7:30 PM) in Monterey, and on Monday, April 12 (7:30 PM) in Carmel.

PREFACE

This document is a revised Supplemental Draft Environmental Impact Report/Environmental Impact Statement (SD EIR/EIS-II) prepared in accordance with the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). This EIR/EIS incorporates information from the Near-Term Desalination Project EIR dealing with site-specific impacts of a desalination project. It should be noted that the water supply performance and environmental impacts (e.g., fish, riparian vegetation) of the overall water resource system are analyzed in this SD EIR/EIS-II.

Improvements to the Cal-Am system will be needed as future water demand increases, even if no project is built. Only conceptual information is available at this time on Cal-Am facilities that may be needed. The site-specific impacts of new Cal-Am facilities or programs will be subject to the formal environmental review process when they are proposed by Cal-Am at some future point in time.

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SUMMARY

SUMMARY

S.1 INTRODUCTION

The Monterey Peninsula Water Management District (MPWMD or "the District") was created by the California legislature in 1978. Its creation was prompted by the severe water shortage on the Monterey Peninsula during the drought of 1976 and 1977. The District boundaries encompass the cities of Carmel, Del Rey Oaks, Monterey, Pacific Grove, Sand City, Seaside and portions of Marina, Fort Ord and Monterey County, primarily in Carmel Valley. Two of the District's principal goals are to expand the Peninsula's water supply and to protect and restore the natural resource values of the Carmel River. These goals became increasingly important during the recent 1987-1992 drought. The District has proposed a 24,000 acre-foot (AF) New Los Padres Dam and Reservoir as a long-term water supply project.

S.2 ENVIRONMENTAL REVIEW

The California Environmental Quality Act (CEQA) requires that an Environmental Impact Report (EIR) be prepared that fully describes the environmental effects of a proposed project, and explores ways to avoid or lessen the environmental effects of a project, before a decision is made to proceed. The National Environmental Policy Act (NEPA) requires that an Environmental Impact Statement (EIS) be prepared on projects that involve federal funding or permitting, in this case a permit pursuant to Section 404 of the Clean Water Act. This document is a combined EIR and EIS, and is intended to fulfill the requirements of both CEQA and NEPA. It functions as a revised Supplemental Draft EIR/EIS-II (SD EIR/EIS-II) to the 1991 Supplemental Draft EIR/EIS on the long-term Monterey Peninsula Water Supply Project. This is a public document that will be used to examine the environmental effects of five alternatives:

- 24,000 AF New Los Padres Dam and Reservoir (24 NLP);
- 24,000 AF New Los Padres Dam and Reservoir combined with a 3 million gallon per day (MGD) desalination plant located in Sand City (24 NLP/D);

- 15,000 AF Cañada Dam and Reservoir combined with a 3 MGD desalination plant located in Sand City (15 CAN/D);
- 7 MGD desalination project (7 DSL), which entails a 3 MGD facility in Sand City and a 4 MGD facility at the Monterey Regional Water Pollution Control Agency (MRWPCA) treatment plant near the City of Marina; and
- No Project (NO PRJ) alternative, which entails facilities and management expected in 1993.

S.2.1 ENVIRONMENTALLY SUPERIOR ALTERNATIVE (CEQA)

The California Environmental Quality Act (CEQA) requires that an EIR identify the "environmentally superior" alternative. All factors considered, the **24,000 AF New Los Padres Reservoir** with or without desalination is identified as the environmentally superior alternative under CEQA. Reasons for this selection include: (1) only the two 24 NLP reservoir alternatives would correct existing damage in the lower Carmel River and provide adequate instream flows for public trust resources in nearly all years; (2) the two 24 NLP alternatives would provide the greatest benefit to the steelhead resource (in some cases, exceeding "natural" conditions), stream-associated riparian wildlife, lagoon habitat and wildlife, water-dependent recreation and aesthetics; and (3) inundation impacts could be mitigated to a less than significant (and in some cases, beneficial) level. Please see Section S.8.1 or Chapter 20 for more information.

S.2.2 ENVIRONMENTALLY PREFERABLE FEASIBLE ALTERNATIVE (NEPA)

The environmentally preferable feasible alternative is a federal definition that refers to the "practicable" alternative that would have the least environmental consequences prior to mitigation. Based on a Clean Water Act, Section 404(b)(1) Compliance Evaluation, the **24,000 AF New Los Padres Reservoir** is identified as the environmentally preferable feasible alternative under NEPA. There would be significant pre-mitigation benefits to the lower Carmel River and public trust resources in nearly all years (including the steelhead resource, stream-associated riparian wildlife, lagoon habitat and wildlife, water-dependent recreation and aesthetics). The 24 NLP alternative would not entail potential adverse effects to sensitive species, energy use and hydrologic concerns associated with the 3 MGD desalination plant. See Section S.8.2 or Chapter 20 for more information.

S.2.3 OVERALL PREFERRED ALTERNATIVE

The overall preferred alternative is the project selected by MPWMD, based on environmental impacts and benefits, water supply performance, cost, reliability and other factors. The District's designation is a **24,000 AF New Los Padres Reservoir combined with a 3 MGD desalination plant** located in Sand City. See Section S.8.3 or Chapter 20 for more information.

S.2.4 SUMMARY TABLES

Table S-1 is a Summary Comparison Matrix that provides the firm yield, increase to the average Cal-Am residential water bill, unavoidable significant impacts and environmental benefits of each alternative. See Section S.4 for a description of the water supply alternatives. For each of the five alternatives, Tables S-2 through S-6 summarize the beneficial and significant adverse impacts of each alternative prior to mitigation, the suggested mitigation measures and the level of impact after mitigation.

S.3 PURPOSE AND NEED FOR A WATER SUPPLY PROJECT

As described in Chapter 2 of the SD EIR/EIS-II, improvements to the Monterey Peninsula's water supply system are needed for several reasons. First, though water supply in average rainfall years far exceeds demand, the area is vulnerable to climatic variability and the impact of multi-year droughts on limited local water supply resources. Whenever two or more sequential dry or critically dry years occur, shortages rapidly develop due to lack of adequate storage or production facilities. The record in the past 90 years shows seven instances of multi-year droughts, some lasting four or more years. Since 1976, the community has suffered mandatory rationing for two extended periods: 18 months in 1976-78, and from January 1, 1989 until May 1, 1991 (28 months).

Second, the demand for water will increase within the District's boundaries as new homes and businesses are built. Tourism, a primary industry in the area, has increased due to construction of the nationally recognized Monterey Bay Aquarium in 1984 as well as increased visitor-serving facilities and attractions. Without an increase in the water supply available to the District, the risk of water shortages in dry years will become greater as time passes. Third, as documented in the MPWMD Water Allocation Program EIR,[1] the present level of water demand adversely affects the environmental quality of the Carmel River because insufficient water supply is available for riparian vegetation and migratory fish.

The MPWMD has already taken a number of actions that address these problems. Actions include implementation of a water conservation program to reduce future water demand, limitations to total system production, improved management of groundwater resources to increase the supply available to the District, and increased pumping capacity in the Seaside Coastal Groundwater Basin. In addition, several river management and mitigation programs have been implemented to improve environmental conditions in the Carmel River. Although beneficial, these actions alone cannot supply sufficient water to meet future demand, improve drought protection nor provide adequate streamflow to protect the environmental quality of the Carmel River.

In August and September 1992, the State Water Resources Control Board (SWRCB) held hearings on complaints against the California-American Water Company (Cal-Am). Complainants alleged that Cal-Am is illegally diverting underflow of the Carmel River, and that existing water supply practices are adversely affecting the public trust resources of the Carmel River. Two dominant themes emerged from the SWRCB hearings -- (1) the existing situation on the Carmel River is unacceptable, significant and adverse in the view of responsible agencies such as the California Department of Fish and Game, environmental groups, and members of the public; and (2) streamflow from a project such as the proposed New Los Padres Reservoir is the only feasible long-term solution to correct the existing damage to fishery and riparian habitat, and provide adequate instream flows to protect the public trust resources of the Carmel River.

The District has proposed a new dam and reservoir on the Carmel River to solve the aforementioned problems. In March 1989, a 24,000 AF New Los Padres Dam was identified as the proposed project for the purposes of the Clean Water Act, Section 404 permit. For this permit, the basic project purpose is to augment water supply to reduce drought vulnerability and provide for allowable planned growth (buildout), as defined by the General Plans of member cities and the County. The overall project purpose is to provide adequate instream flow to protect the public trust resources of the Carmel River at least 85 percent of the time.

S.4 WATER SUPPLY ALTERNATIVES

As described in Chapter 3 of the SD EIR/EIS-II, the MPWMD evaluated a broad range of water supply alternatives over the course of several years. Possibilities included various reservoirs, both on and off the Carmel River, groundwater development in Carmel Valley and Seaside, groundwater

TABLE S-1: SUMMARY COMPARISON MATRIX

Alternative	Yield (AF)[1]	Cost ($/2-mo)[2]	Unavoidable Significant Impacts[3]	Environmental Benefits[4]
24,000 AF New Los Padres Reservoir	18,320	$8.55	SU - Construction impacts (traffic, noise, air quality). SU - Discontinuous river flow in critically dry years (13% of time). SU - Compared to natural conditions, streamflows would be reduced for steelhead upstream migration in severe droughts. PSU - Adverse effects to lower Carmel River riparian habitat due to drawdown in droughts (13% of time).	Substantial improvement in Carmel River streamflow and Carmel Valley aquifer storage conditions in most years. Improved steelhead fry and juvenile habitat; smolt emigration; fish passage at Los Padres and San Clemente Dams; and water temperatures. 115 acres of improved riparian habitat in lower Carmel Valley; improved aesthetic and recreational conditions in lower Carmel Valley. Improved lagoon/wetland and stream-associated wildlife habitat.
24,000 AF New Los Padres Reservoir w/3 MGD Desalination Plant	21,020	$17.79	SU - Construction impacts (traffic, noise, air quality). SU - Discontinuous river flow in critically dry years (13% of time). SU - Compared to natural conditions, streamflows would be reduced for steelhead upstream migration in severe droughts. PSU - Adverse effects to lower Carmel River riparian habitat due to drawdown in droughts (13% of time).	Substantial improvement in Carmel River streamflow and Carmel Valley aquifer storage conditions in most years. Improved steelhead fry and juvenile habitat; smolt emigration; fish passage at Los Padres and San Clemente Dams; and water temperatures. 115 acres of improved riparian habitat in lower Carmel Valley; improved aesthetic and recreational conditions in lower Carmel Valley. Improved lagoon/wetland and stream-associated wildlife habitat.
15,000 AF Cañada Reservoir w/3 MGD Desalination Plant	20,150	$26.96	SU - Construction impacts (traffic, noise, air quality, energy). SU - Chronic periods of inadequate and discontinuous flow in the Carmel River; results in impacts on steelhead upstream migration, lagoon/ wetland, stream-associated wildlife and river-based recreation. PSU - System operation impairs ability to pass steelhead over existing dams. PSU - Adverse effects to riparian corridor due to drawdown in droughts (13% of time).	115 acres of improved riparian habitat in lower Carmel Valley due to higher groundwater levels; improved aesthetic conditions in lower Carmel Valley.
7 MGD Desalination Plant	22,760	$20.83	SU - Chronic periods of inadequate and discontinuous flow in the Carmel River; results in impacts on steelhead upstream migration, lagoon/wetland, stream-associated wildlife and river-based recreation. SU - Noise generated during construction. PSU - Inadequate streamflow would degrade 120 acres of riparian habitat in the lower Carmel Valley, which also affects wildlife and visual resources. PSU - System operation would impair steelhead passage over existing dams.	None.

TABLE S-1: Summary Comparison Matrix (Continued)

Alternative	Yield (AF)[1]	Cost ($/2-mo)[2]	Unavoidable Significant Impacts[3]	Environmental Benefits[4]
No Project	16,460[5]	$3.27	SU - Chronic periods of inadequate and discontinuous flow in the Carmel River; results in impacts on steelhead upstream migration, lagoon/wetland, stream-associated wildlife and river-based recreation. PSU - Inadequate streamflow would degrade 120 acres of riparian habitat in the lower Carmel Valley, which also affects wildlife and visual resources. PSU - System operation would impair steelhead passage over existing dams.	None.

1 Simulated 1990 drought year yield; annual buildout demand would be 22,750 AF Cal-Am production in a normal year, but would increase to 23,890 AF in a drought year like 1990.

2 Estimated bi-monthly increase to average residential Cal-Am water bill (average present worth in 1992 dollars). Based on estimated total project costs for the period 1994 through 2020. Future costs were converted to their 1992 value using a present worth computation at 5 percent per year. For combination projects (24 NLP/D, 15 CAN/D), costs assume construction of desalination component in year 1994, with first year of operation in 1995, followed by construction of dam in 1999-2001, with first year of operation in 2002.

3 SU = Significant and Unavoidable.
PSU = *Potentially Significant and Unavoidable.*

4 Benefits are *prior* to mitigation. All reservoirs would provide enhanced recreational opportunities.

5 No Project entails a normal year demand of 17,359 AF Cal-Am production, which would increase to 18,230 AF in a drought year like 1990.

TABLE S-2: SUMMARY OF ENVIRONMENTAL IMPACTS - 24 NLP

Impact Area	Impact	Signif w/o Mit	Mitigation	Signif w/Mit
Geology and Seismicity	Construction activities would expose disturbed soils to erosive forces.	S	Restricted vegetation clearing; engineered slope designs; replacement of topsoil and revegetation of disturbed areas; engineered drainage control.	LS
	Possible reservoir-induced seismicity and landslides.	S	Proper dam design; stabilize slopes.	LS
Hydrology and Water Quality	Substantial improvement in streamflow and Carmel Valley aquifer conditions in most years; riparian growth would stabilize river banks.	B	None necessary.	B
	Discontinuous river flow in critically dry years (13% of time).	S	Inadequate storage available to release flow in severe droughts.	SU
	Loss of capacity in river channel below the dam; potential increase in flood elevations; alteration of sediment transport and deposition characteristics.	PS	Establish pre-project baseline conditions. Monitor channel changes. Remove accumulated sediment and/or vegetation, if needed.	LS
	Dam construction could adversely affect Carmel River water quality.	S	Wastewater treatment; sediment control; spill prevention/control plan.	LS
Fish and Aquatic Life	Reservoir would inundate 12% of the steelhead spawning habitat and 14% of rearing habitat in the Carmel Basin.	S	Increase and maintain spawning habitat below new dam; proposed reservoir operational schedule.	LS to B
	Project operation would reduce upstream migration opportunities in severe droughts.	S	Inadequate storage available to release flow in severe droughts.	SU
	Improved fry and juvenile habitat; smolt emigration; upstream and downstream migration conditions at Los Padres and San Clemente Dams; and water temperatures.	B	None necessary.	B
	Sedimentation during construction could damage aquatic habitats.	S	Construction of migration facilities; sediment traps; contingency funding.	LS
Vegetation and Wildlife	Reservoir would inundate 39 acres of riparian habitat and 7 acres of valley oak woodland.	S	Restore and enhance 50.5 acres of riparian habitat within Garland Ranch; enhance 22 acres of valley oak savannah adjacent to damsite.	LS
	Five sensitive species and 2 acres of marsh affected.	LS	New marsh created at upper end of reservoir; species population not threatened.	LS
	Construction staging and roads would impact 23 acres of upland habitat.	S	Implement revegetation and restoration plan.	LS
	Improved streamflow would benefit 115 acres of lower Carmel Valley riparian habitat, lagoon and stream-associated wildlife in most years.	B	None necessary	B
	Impacts to riparian habitat in critically dry years (13% of time).	S	Riparian management plan; monitoring; irrigation and planting program.	PSU

TABLE S-2: Summary of Environmental Impacts - 24 NLP (Continued)

Impact Area	Impact	Signif w/o Mit	Mitigation	Signif w/Mit
Traffic	Dam construction would result in elevated traffic levels on Highway 1, Carmel Valley Road and Cachagua Road.	S	Avoid peak traffic periods; transport workers to the site via shuttle bus.	SU
	Possible road damage from construction vehicles.	S	Repair road damage.	LS
	Minor increase in vehicles to operate dam.	LS	None necessary.	LS
Air Quality	Dam construction would result in exhaust, smoke and dust emissions.	S	Reduction of worker traffic volumes; proper burning practices; dust abatement practices.	SU
	Minor increase in vehicle emissions to operate dam; local influence on air temperature.	LS	None necessary.	LS
Noise	Ambient noise levels would be increased during construction.	S	Controlled blasting; siting of rock crushing plant; proper muffling of vehicles and equipment.	SU
	Minor increase in noise to operate dam.	LS	None necessary.	LS
Visual Quality	Improved streamflow would benefit aesthetic conditions of lower Carmel River.	B	None necessary.	B
	Replace existing dam and reservoir with larger structures.	LS	None necessary.	LS
History and Archaeology	13 archaeological and 5 traditional cultural properties recommended for federal listing would be inundated.	S	Cultural Resources Mitigation Plan, extensive site investigations, support for Esselen Tribe activities, avoidance of sites, access to Tribe.	LS
Public Health and Safety	Hazardous construction project for workers.	S	Rigorous safety procedures; Emergency Action Plan; Fire Prevention Plan.	LS
	Dam failure would result in the inundation of private property and possibly the loss of human life.	S	Proper design, construction and operation of the dam; preparation of emergency evacuation plan.	LS
	Channel narrowing could increase flood elevations.	PS	Monitoring trends; vegetation and channel maintenance.	LS
Energy	Minimal energy consumption.	LS	None necessary.	LS
Land Use, Planning and Recreation	Reservoir would affect 23 acres of the Ventana Wilderness.	S	Exchange of 140 acres of private land adjacent to the Wilderness for the 23 acres inundated.	LS
	Loss of hiking trail and campsite.	S	Rebuild trail and campsite.	LS
	Enhanced recreation opportunities.	B	None necessary.	B
Growth Effects	Project allows presently constrained planned growth ("growth inducing"); increased traffic congestion and vehicle emissions.	S	Most mitigations outside MPWMD authority; phase new water for growth consistent with Air Quality Management Plan population projections.	LS/?

S = Significant PS = Potentially Significant SU = Significant and Unavoidable
B = Beneficial LS = Less than Significant PSU = Potentially Significant and Unavoidable

TABLE S-3: SUMMARY OF ENVIRONMENTAL IMPACTS - 24 NLP/D

Impact Area	Impact	Signif w/o Mit	Mitigation	Signif w/Mit
Geology and Seismicity	Reservoir impacts same as 24 NLP.	S	Same as 24 NLP.	S
	Desal plant construction activities could adversely affect geology and soils.	S	Site-specific geotechnical investigations; grading and erosion control plans; dune sand stabilization.	LS
Hydrology and Water Quality	Reservoir impacts same as 24 NLP.	S to B	Same as 24 NLP.	LS to B
	Desalination plant operation would affect groundwater hydrology and marine water quality.	LS	Monitoring of marine community.	LS
Fish and Aquatic Life	Reservoir impacts same as 24 NLP.	S to B	Same as 24 NLP.	B to SU
	Discharge of desalination brine could adversely affect marine life.	LS	Monitoring of marine community.	LS
Vegetation and Wildlife	Reservoir impacts same as 24 NLP.	S to B	Same as 24 NLP.	LS to B
	Desalination plant construction could adversely affect sensitive animal species.	S	Avoidance; on-site monitoring during construction; revegetation.	LS
Traffic	Reservoir impacts same as 24 NLP.	LS to S	Same as 24 NLP.	LS to SU
	Desalination plant construction would temporarily increase local traffic levels.	LS	Provide adequate parking; avoid peak-hour travel periods; minimize traffic disturbance during pipeline construction.	LS
Air Quality	Reservoir impacts same as 24 NLP.	LS to S	Same as 24 NLP.	LS to SU
	Desalination plant construction could adversely affect air quality.	LS	Dust and odor controls; watering of bare soils.	LS
	Operation of the desalination plant would be inconsistent with the 1991 AQMP.	S	Revise AQMP.	LS
Noise	Reservoir impacts same as 24 NLP.	LS to S	Same as 24 NLP.	LS to SU
	Operation of a desalination plant could increase ambient noise levels.	S	Proper acoustic design and construction.	LS
	Desal construction noise would be adverse.	S	Unavoidable.	SU
Visual Quality	Reservoir impacts same as 24 NLP.	LS to B	None necessary.	LS to B
	No substantial visual impacts.	LS	Painting of building and revegetation of disturbed areas.	LS
History and Archaeology	Inundation impact same as 24 NLP.	S	Same as 24 NLP.	LS
	Potential disturbance of undiscovered resources.	S	Halt construction and evaluate findings.	LS
Public Health and Safety	Reservoir impacts same as 24 NLP.	PS to S	Same as 24 NLP.	LS
	Minimal impacts of desalination.	LS	None necessary.	LS
Energy	Desalination plant would consume an average of 16,000 Mwh per year.	LS	Maximize energy efficiency.	LS
Land Use, Planning and Recreation	Same as 24 NLP.	S to B	Same as 24 NLP.	LS to B
Growth Effects	Same as 24 NLP.	S	Same as 24 NLP.	LS/?

S = Significant
B = Beneficial
PS = Potentially Significant
LS = Less than Significant
SU = Significant and Unavoidable
PSU = Potentially Significant and Unavoidable

TABLE S-4: SUMMARY OF ENVIRONMENTAL IMPACTS - 15 CAN/D[1]

Impact Area	Impact	Signif w/o Mit	Mitigation	Signif w/Mit
Geology and Seismicity	Reservoir impacts same as 24 NLP.	S	Same as 24 NLP.	LS
Hydrology and Water Quality	Chronic periods of intermittent or inadequate flow in the Carmel River.	S	None available.	SU
	Very low groundwater storage levels in the Seaside Coastal subbasin in droughts.	PS	Reduce pumping to the degree possible.	PSU
	Potential for the accumulation of sediment at and below the diversion point.	PS	Physical removal of accumulated sediments.	LS
Fish and Aquatic Life	Project operation would reduce upstream migration opportunities.	S	Potential change in operational schedule.	SU
	Project operation would reduce spawning habitat below San Clemente Dam; increase stranding of juveniles; decrease smolt emigration; delay or block migration at San Clemente and Los Padres dams; and result in unacceptable water temperatures.	S	Potential operational changes; continued juvenile and smolt rescue programs; construct improved passage facilities at Los Padres Dam.	PSU
	Sedimentation during construction of diversion facility could damage aquatic habitats.	S	Construction of migration facilities; sediment traps; contingency funding.	LS
Vegetation and Wildlife	Reservoir and diversion facility would eliminate 4.4 acres of riparian habitat.	S	Restore and enhance 6.3 acres of riparian habitat within Garland Ranch.	LS
	Higher groundwater levels would improve conditions for 115 acres of riparian habitat in the lower Carmel Valley in most years.	B	None necessary.	B
	Impacts to riparian habitat in critically dry years (13% of time).	S	Riparian management plan; monitoring; irrigation and planting program.	PSJ
Traffic	Dam construction would result in elevated traffic levels on Highways 1 and 68, and Carmel Valley Road.	S	Maximize use of Highway 68; fund road improvements; avoid peak traffic periods; transport workers to the site via shuttle bus.	SU
	Operation impacts same as 24 NLP.	LS	None necessary.	LS
Air Quality	Reservoir impacts same as 24 NLP.	S	Same as 24 NLP.	SU
Noise	Construction impacts same as 24 NLP.	S	Same as 24 NLP.	SU
	Diversion facility could have adverse noise impact.	S	Proper acoustical design.	LS
Visual Quality	Chronic lack of streamflow would degrade aesthetic conditions of the lower Carmel River.	S	Riparian management plan; monitoring; irrigation and planting program.	PSU
	Dam and reservoir changes visual character.	LS	Isolated area; none necessary.	LS
History and Archaeology	Two known archaeological sites could be affected by the reservoir.	PS	Archaeological monitoring during construction.	LS
Public Health and Safety	Same as 24 NLP, except for channel impacts.	S	Same as 24 NLP.	LS
Energy	Project construction would consume about 9 times more energy than any other alternative.	S	None available.	SU
	Pumped storage and desal operations would consume an average of 20,000 Mwh of electricity per year.	LS	None necessary.	LS

TABLE S-4: Summary of Environmental Impacts - 15 CAN/D (Continued)

Impact Area	Impact	Signif w/o Mit	Mitigation	Signif w/Mit
Land Use, Planning and Recreation	Reservoir construction would preclude development of the site.	S	Coordination and prioritization of land uses.	LS
	Public recreation opportunities enhanced at reservoir.	B	None necessary.	B
	Chronic lack of streamflow would impair river-based recreation.	S	None available; no releases from reservoir.	SU
Growth Effects	Same as 24 NLP.	S	Same as 24 NLP.	LS/?

[1] 3 MGD desalination impacts are described in Table S-3 for 24 NLP/D alternative.

S = Significant
B = Beneficial
PS = Potentially Significant
LS = Less than Significant
SU = Significant and Unavoidable
PSU = Potentially Significant and Unavoidable

TABLE S-5: SUMMARY OF ENVIRONMENTAL IMPACTS - 7 DSL

Impact Area	Impact	Signif w/o Mit	Mitigation	Signif w/Mit
Geology and Seismicity	Construction activities would involve excavation, grading and trenching; subsidence.	S	Erosion control measures; geotechnical studies.	LS
Hydrology and Water Quality	Chronic periods of intermittent or inadequate flow in the Carmel River.	S	None available.	SU
Fish and Aquatic Life	Project operation would reduce upstream migration opportunities and would delay or block migration at San Clemente and Los Padres Dams.	S	Construct improved passage facilities at Los Padres Dam; none available for upstream migration.	PSU SU
	Project operation would reduce spawning habitat below San Clemente Dam; increase stranding of juveniles; and decrease smolt emigration.	S	Improve spawning habitat; continued juvenile and smolt rescue programs.	LS
Vegetation and Wildlife	Chronic lack of streamflow would result in adverse effects to 115 acres of riparian habitat and stream-associated wildlife in the lower Carmel Valley.	S	Riparian management plan; monitoring; irrigation and planting program.	PSU
	Pipelines and/or radial wells could affect sensitive species.	PS	Surveys and avoidance, where possible; revegetation.	PSU/ LS
Traffic	Project construction would result in elevated traffic levels and possibly traffic delays.	S	Avoid peak traffic periods; maintain traffic flows.	LS
Air Quality	Minor construction impacts.	LS	Standard dust control measures.	LS
Noise	Construction noise would be adverse.	S	None available.	SU
	Plant operation could increase ambient noise levels.	S	Proper acoustic design and construction.	LS
Visual Quality	Chronic lack of streamflow would degrade aesthetic conditions of the lower Carmel River.	S	Riparian management plan; monitoring; irrigation and planting program.	PSU
History and Archaeology	No known archaeological sites would be affected.	LS	Archaeological monitoring during construction.	LS
Public Health and Safety	No significant impacts.	LS	None necessary.	LS
Energy	Desalination plant would consume an average of 38,000 Mwh of electricity per year.	LS	Maximize energy efficiency.	LS
Land Use, Planning and Recreation	Chronic lack of streamflow would impair river-based recreation.	S	None available.	SU
Growth Effects	Same as 24 NLP.	S	Same as 24 NLP.	LS/?

S = Significant
B = Beneficial
PS = Potentially Significant
LS = Less than Significant
SU = Significant and Unavoidable
PSU = Potentially Significant and Unavoidable

TABLE S-6: SUMMARY OF ENVIRONMENTAL IMPACTS - NO PRJ

Impact Area	Impact	Signif w/o Mit	Mitigation	Signif w/Mit
Geology and Seismicity	None		None necessary.	
Hydrology and Water Quality	Chronic periods of intermittent or inadequate flow in the Carmel River in normal and dry years.	S	None available.	SU
Fish and Aquatic Life	Project operation would reduce upstream migration opportunities; would delay or block migration at San Clemente and Los Padres Dams; and would result in unacceptable water temperatures.	S	Construct improved passage facilities at Los Padres Dam.	PSU to SU
	Project operation would reduce spawning habitat and fry and juvenile habitat below San Clemente Dam; increase stranding of juveniles; and decrease smolt emigration.	S	Improve spawning habitat; continued juvenile, migrant and smolt rescue programs.	LS
Vegetation and Wildlife	Chronic lack of streamflow would result in adverse effects to 115 acres of riparian habitat and stream-associated wildlife in the lower Carmel Valley.	S	Riparian management plan; monitoring; irrigation and planting program.	PSU
Traffic	Minor and temporary.	LS	None necessary.	LS
Air Quality	None.		None necessary.	
Noise	Minor and temporary.	LS	None necessary.	LS
Visual Quality	Chronic lack of streamflow would degrade aesthetic conditions of the lower Carmel River.	S	Riparian management plan; monitoring; irrigation and planting program.	PSU
History and Archaeology	None.		None necessary.	
Public Health and Safety	None.		None necessary.	
Energy	Minor energy consumption from the construction and operation of new wells.	LS	None necessary.	LS
Land Use, Planning and Recreation	Chronic lack of streamflow would impair river-based recreation.	S	None available.	SU
Growth Effects	Minor increase in growth.	LS	None necessary.	LS

S = Significant PS = Potentially Significant SU = Significant and Unavoidable
B = Beneficial LS = Less than Significant PSU = Potentially Significant and Unavoidable

recharge, importation from distant sources, dredging, desalination, wastewater reclamation and conservation, including cisterns. Selection criteria included cost, water supply performance, availability, logistical and technical constraints as well as environmental issues. The selection process involved public participation at workshops as well as an interagency group chaired by U.S. Representative Leon Panetta.

From an initial set of 32 alternatives, 10 were analyzed in the 1991 SD EIR/EIS, and infeasible projects were identified. The five alternatives analyzed in this document are included in response to agency requests and incorporate new information developed in 1992. Each are described in detail in Chapter 4 and are summarized below. Figure S-1 provides the location of each alternative.

The District has also completed a revised draft Clean Water Act, Section 404(b)(1) Compliance Evaluation. This document is used by the Army Corps of Engineers in its permit decision process, and identifies which alternatives are considered to be "practicable" (feasible).

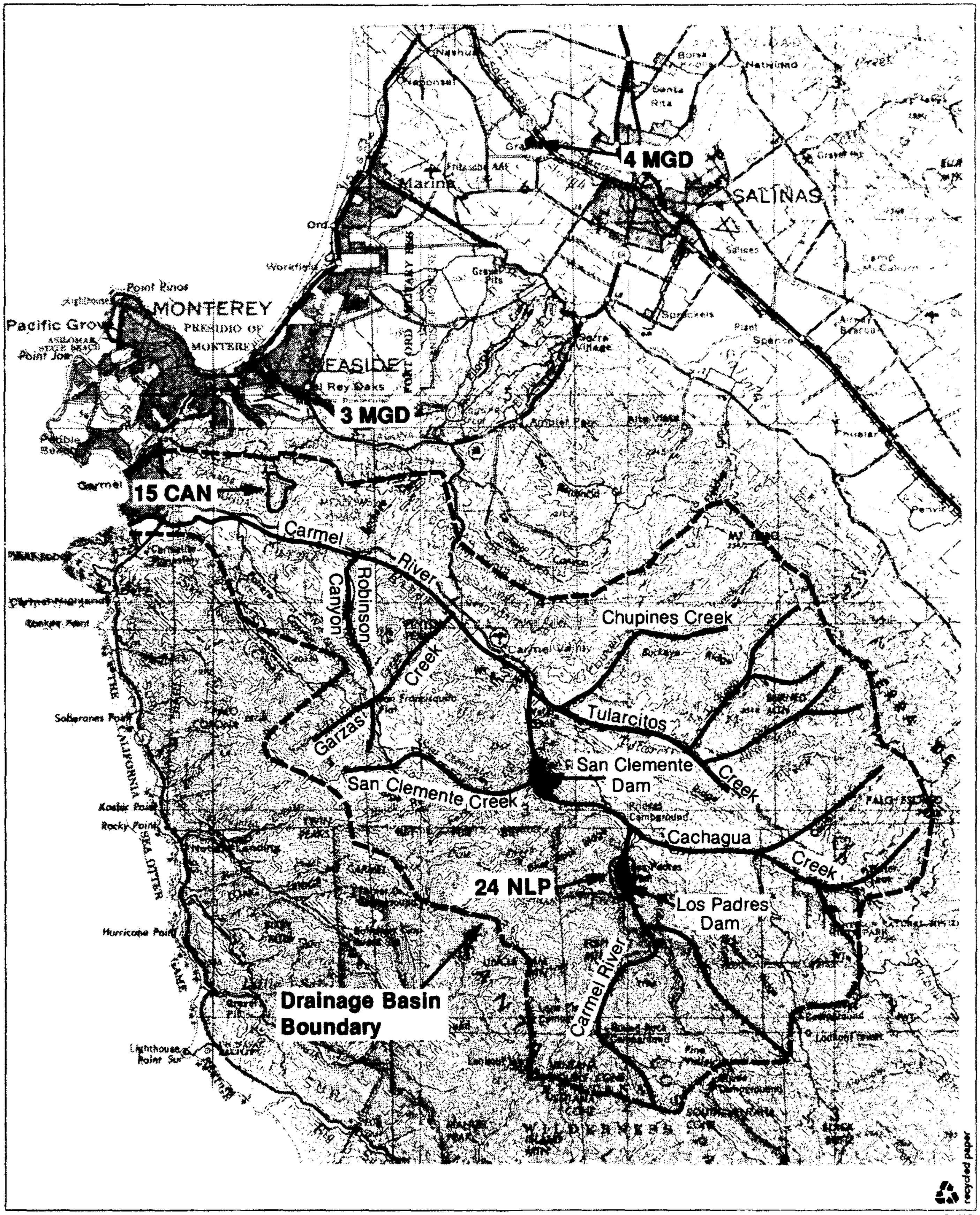
S.4.1 24,000 AF NEW LOS PADRES RESERVOIR (24 NLP)

New Los Padres Dam would be a roller-compacted concrete (RCC) dam located on the Carmel River about 2,400 feet downstream of the existing Los Padres Dam. The 24,000 AF reservoir would have a surface area of about 266 acres at the spillway crest elevation of 1,130 feet, and would completely inundate the existing Los Padres Dam. Fish passage facilities would be included. Construction would last for about 22 months. The proposed reservoir would inundate four acres and affect another 19 acres of the Ventana Wilderness. This would be compensated for by a land exchange of 23 acres of Wilderness land for 140 acres of adjacent, high quality lands allowed by an Act of Congress (P.L. 101-539).

The 24,000 AF reservoir size was selected for two reasons: (1) any larger size would inundate additional areas of the Ventana Wilderness that were not contemplated in the land exchange approved by Congress; and (2) reservoir sizes smaller than 24,000 AF would not provide adequate storage to meet municipal demand as well as instream flow requirements recommended by the interagency Fishery Working Group.

LOCATION OF WATER SUPPLY ALTERNATIVES

FIGURE S-1



SOURCE: USGS 1 : 250,000 MONTEREY

MILES 0 2.5 5

91417

S.4.2 24,000 AF NEW LOS PADRES RESERVOIR WITH A 3 MGD DESALINATION PLANT (24 NLP/D)

The 24 NLP/D alternative would be the same as the 24 NLP alternative except that a 3 MGD desalination plant located in Sand City would be included. The desalination component would entail reverse osmosis facilities in an existing warehouse, three radial wells (Ranney collectors) subsurface to collect raw seawater, two Ranney injectors to discharge brine effluent into the shallow dune sand aquifer, pipelines and storage tanks.

S.4.3 15,000 AF CAÑADA RESERVOIR WITH A 3 MGD DESALINATION PLANT (15 CAN/D)

The proposed Cañada Dam would be an earth- and rock-fill embankment dam located in a canyon called Cañada de la Segunda on the north side of Carmel Valley. This alternative would be operated as an off-stream pumped storage facility, pumping surplus water from the Carmel River during periods of high runoff for later use. The 15,000 AF reservoir would have a surface area of 200 acres at the maximum operating level of 455 feet. It would be operated in conjunction with a 3 MGD desalination plant at the Sand City site.

S.4.4 7 MGD DESALINATION PLANT (7 DSL)

The 7 DSL alternative would entail two desalination plants constructed in two phases: first, the 3 MGD desalination plant would be built in Sand City followed by construction of a 4 MGD plant at the Monterey Regional Water Pollution Control Agency (MRWPCA) treatment plant near the City of Marina. At the MRWPCA site, raw seawater would be transported by pipeline from two beach wells; discharged brine would be combined with treated effluent at the MRWPCA treatment plant and discharged into Monterey Bay through the existing outfall. A 7.5-mile pipeline would convey product water to the Cal-Am distribution system in Seaside.

S.4.5 NO PROJECT (NO PRJ)

The No Project alternative reflects conditions expected in year 1993. It entails existing facilities in addition to a new Cal-Am well (Paralta Well) in Seaside. Annual Cal-Am water production would be limited to 17,359 AF in a normal year.

It should be noted that all alternatives would entail the District's long-term conservation program, which includes wastewater reclamation for turf irrigation. Other conceptual components common to all alternatives entail Cal-Am programs such as production, distribution and treatment improvements, as well as maintenance dredging of existing reservoirs, where applicable.

S.5 PROJECT COSTS

The project costs for each alternative are shown in Table S-7, based on information presented in Chapter 4 of this SD EIR/EIS-II. Estimated total capital costs in 1992 dollars range from $4.8 million for the No Project alternative to over $184 million for the 15 CAN/D alternative. The estimated operation and maintenance (O&M) costs in 1992 dollars range from $1.3 million for the No Project alternative to $7.7 million for the 7 DSL alternative. The annual O&M costs for all alternatives, particularly for projects that include desalination, would be higher in drought years and lower in wetter than normal years. The estimated present worth in 1992 dollars of total future costs projected to the year 2020 range from $32.8 million for the No Project alternative to $282.5 million for the 15 CAN/D alternative.

As explained in Chapter 18 of the SD EIR/EIS-II, the average increase in bi-monthly water costs for residential Cal-Am customers (based on the present worth analysis noted above) would range from $3.27 for the No Project alternative to nearly $27 for the 15 CAN/D alternative, in 1992 dollars. These costs would be in addition to the base Cal-Am bill. Cal-Am's 1992 rates applied to an average residential water use of 19 units per two-month period equates to about $58 every two months. Note that the actual bill increase experienced by each residential customer would likely differ from the averages presented here, since individual users consume different amounts of water.

The present worth and residential bill costs shown in Table S-7 for projects that combine a dam with a desalination plant (24 NLP/D and 15 CAN/D) assume construction of the desalination component first, followed by the dam component.

These cost estimates do not include significant Cal-Am rate increases that are likely to occur in the future. New Cal-Am facilities will be needed to meet recent amendments to federal water quality regulations.

TABLE S-7

SUMMARY OF COST ESTIMATES[1]

PROJECT	Total[2] Capital Cost ($mil)	Annual[3] O&M Cost ($mil)	Present[4,6] Worth of Total Project Costs, through 2020 ($mil)	Increase to[5,6] Average Residential Water Bill ($/2-mo)
24 NLP	$92.3	$1.5	$114.9	$ 8.55
24 NLP/D	119.9	3.9	204.9	17.79
15 CAN/D	184.4	4.8	282.5	26.96
7 DSL	86.3	7.7	246.0	20.83
NO PRJ	4.8	1.3	32.8	3.27

1 Costs include project expenses, mitigations and Cal-Am improvements described in Chapter 4 of the SD EIR/EIS-II.
2 Capital costs are presented in 1992 dollars.
3 Annual operation and maintenance costs in 1992 dollars.
4 Present worth includes all capital and O&M costs for MPWMD and Cal-Am components for the period 1994 through 2020, in 1992 dollars.
5 Average present worth (1992) bimonthly costs, based on estimated total project costs for the period 1994 through 2020.
6 Future costs were converted to their 1992 value using a present worth computation at 5 percent per year. For combination projects (24 NLP/D, 15 CAN/D), costs assume construction of desalination component in year 1994, with first year of operation in 1995, followed by construction of dam in 1999-2001, with first year of operation in 2002.

Assumes average residential water use at 19 units per 2-month bill.

Project and Cal-Am base costs do not include significant Cal-Am rate increases that are likely to occur by the year 2000. New facilities will be needed to meet recent amendments to federal water quality regulations.

Source: MPWMD

S.6 WATER SUPPLY PERFORMANCE

The ability of each alternative to meet future water demand, if streamflow patterns similar to those from water years 1902 through 1991 occurred again, was determined using the District's CVSIM computer simulation model. CVSIM simulates water supply performance, among other things, based on inputs such as reservoir size, project operations and future Cal-Am demand. The water supply performance at buildout, defined as 22,750 AF of annual Cal-Am production, is of primary interest because it reflects the maximum allowable water supply needs associated with planned growth. The District Board has determined that a project goal is to meet 90 percent of annual Cal-Am demand at all water years; this corresponds to no more than a 10 percent shortage in any of the 90 years simulated.

In this analysis, demand management, including mandatory rationing was assumed. All projects would be operated in conjunction with existing Cal-Am facilities, which assume the new Paralta Well in Seaside. It should be noted that all simulations assume that the community would have already achieved a 15 percent reduction in demand due to long-term conservation measures. Average residential water use would be about 79 gallons per person per day (gppd), compared to 93 gppd in 1988. Refer to Chapter 5 of the SD EIR/EIS-II for more information.

It should be noted that water supply performance of all long-term alternatives would be improved at demand levels lower than the 22,750 AFA buildout demand used in this analysis. For example, there would be no significant shortages with any long-term alternative at a Cal-Am demand of 20,000 AF/year.

24,000 AF New Los Padres Project (24 NLP)

The 24 NLP alternative would be able to meet the District Board's desired performance about 95 percent of the time at a buildout demand of 22,750 AF Cal-Am annual production. However, due to the substantial amount of water released from storage for instream benefits in many dry years, water supply performance with the 24 NLP alternative begins to be impaired by the third or fourth year of a severe multi-year drought. If water year 1990 were simulated at buildout, the 24 NLP alternative would provide a firm yield of 18,320 AF, which corresponds to a 23 percent shortage in that year (Table S-8). The 24 NLP alternative would not meet the District's "90 percent goal" in all years unless Cal-Am production were limited to 20,500 AF per year. This amount would permit

TABLE S-8

WATER SUPPLY PERFORMANCE OF
LONG-TERM ALTERNATIVES AT BUILDOUT[1]

Alternative	Firm[2] Yield (AF)	Percent Shortage in Worst Year	Years of[3] Growth Provided
24 NLP	18,320	23%	20
24 NLP/D	21,020	12%	34
15 CAN/D	20,150	15%	27
7 DSL	22,760	2%	34

[1] Buildout assumes a normal year demand of 22,750 AF Cal-Am production. This demand would be as high as 23,890 AF in a critically dry year, which is used for the firm yield calculation.

[2] Firm yield is defined as Cal-Am annual yield in the simulated year with the greatest shortage. Yield does not include instream releases, non Cal-Am yield or drought reserve in storage.

[3] Assumes a growth rate of 160 AF/year of new production beginning with a base demand of 17,359 AF annual Cal-Am production. The 34 years is a maximum, based on an assumed demand of 22,750 AF Cal-Am production at buildout.

Source: MPWMD

about 20 years of growth at a rate of 160 AF/year of new production, assuming a base of 17,359 AF/year Cal-Am production. If more growth is to be supplied at the 90 percent performance level, it would be necessary to add a desalination plant, which is the 24 NLP/D alternative described below.

24,000 AF New Los Padres Reservoir/Desalination (24 NLP/D)

The addition of the 3 MGD desalination plant to the 24,000 AF New Los Padres Reservoir would result in a significant improvement to municipal water supply at buildout (22,750 AF Cal-Am production). The 24 NLP/D alternative would meet the District Board's desired performance standard 99 percent of the time (all simulated years except for 1990). The 21,020 AF yield in simulated water year 1990 corresponds to a 12 percent shortage in that year, which is slightly greater than the desired maximum of a 10 percent snortage (Table S-8). Rationing would be eliminated with the 24 NLP/D alternative in the 1977-78 drought event. This alternative would provide adequate supply for about 34 years (buildout) assuming a growth rate of 160 AF/year of new production and a base demand of 17,359 AF production, as well as provide instream benefits.

15,000 AF Cañada Reservoir/Desalination (15 CAN/D)

The 15 CAN/D alternative would meet the District "90 percent goal" 99 percent of the time (all years except 1990). The 20,150 AF yield in simulated water year 1990 corresponds to a 15 percent shortage in that year, which is somewhat greater than the desired maximum of a 10 percent shortage (Table S-8). Performance would be reduced in multi-year droughts as there would be few opportunities to divert water into the reservoir. In order to attain the "90 percent goal" in all years, Cal-Am demand would need to be reduced to about 21,500 AF to 21,750 AF production per year with this alternative; this corresponds to about 27 years of growth.

7 MGD Desalination (7 DSL)

The 7 DSL alternative would provide greater water supply benefits than any other long-term alternative. It would meet the District "90 percent goal" in all years. The 22,760 AF yield in simulated water year 1990 corresponds to a two percent shortage in that year (Table S-8). This alternative could provide adequate supply for buildout demand (about 34 years of growth).

It should be noted that the excellent simulated water supply performance of the 7 DSL alternative depends on and assumes very similar levels of diversion and pumping from the Carmel River that

presently exist. As described in Section S.8.2 and Chapter 4, Section 4.9, the State Water Resources Control Board (SWRCB) is considering complaints against Cal-Am that allege that existing supply practices damage the public trust resources of the Carmel River. It is possible that the SWRCB could enact more stringent conditions on diversions from the Carmel River and pumping from the Carmel Valley alluvial aquifer. If this were the case, the performance of the 7 DSL alternative would be impaired.

No Project

The No Project alternative in this SD EIR/EIS-II reflects conditions expected in the year 1993 with the new Paralta Well in Seaside. Annual water demand would be limited to 17,359 AF Cal-Am production, which would allow 385 AF/year of new production for a limited amount of growth. The No Project alternative would always meet the 90 percent goal at this constrained level of demand, but would not meet the basic project purpose of providing long-term supply for planned growth. It is not directly comparable to the long-term alternatives described above due to the substantial difference in demand that is assumed.

If annual Cal-Am demand were allowed to increase to 22,750 AF with the No Project facilities, the "90 percent goal" would still be met in about 88 percent of the water years simulated. However, shortages of up to 30 percent would occur in droughts, and mandatory rationing would be expected about once each decade.

As described for the 7 DSL alternative above, complaints before the SWRCB have been filed against Cal-Am regarding existing water supply practices. It is possible that more stringent conditions could be placed on the use of the water resource system, which would affect the No Project performance. The SWRCB is expected to issue an order on the complaints in Spring 1993.

S.7 ENVIRONMENTAL IMPACTS OF THE PROJECT ALTERNATIVES

S.7.1 GEOLOGY AND SEISMICITY

The Geology and Seismicity analysis (Chapter 6 in the SD EIR/EIS-II) focuses on project operation and construction impacts on reservoir-induced seismicity, landslide potential, and erosion potential.

24,000 AF New Los Padres Reservoir (24 NLP)

The geological resources within and surrounding the 24 NLP are unremarkable and have no special or unusual geologic value. The inundation of the reservoir area is therefore not expected to result in the loss of any significant geologic features.

The change of pressure that results when a reservoir is first filled, or is rapidly drawn down, could trigger a phenomenon known as reservoir-induced seismicity (RIS). This generally occurs only with reservoirs that are much larger and deeper than the New Los Padres alternative. Even if RIS should occur with the 24 NLP alternative, the impact would be less than significant because the dam would be designed to withstand the Maximum Credible Earthquake (MCE) for this site; the MCE would greatly exceed the seismic forces that might be triggered by RIS.

Operation of the 24 NLP could trigger landsliding into the reservoir from the adjacent slopes. However, the total volume of active and inactive landslides in the area is very small compared to the size of the proposed reservoir. If all of these slide masses moved into the reservoir, this movement is not expected to generate a wave that could overtop the dam and cause damage downstream or to the dam's integrity. Potentially unstable slopes in the reservoir area would be removed and/or stabilized prior to filling of the reservoir.

Excavation, grading and road-building activities associated with construction of the 24 NLP alternative would result in the exposure of bare soil and rock surfaces to the erosive forces of wind and rain. Mitigation measures to reduce the erosion rate to a less than significant level include restricted vegetation clearing outside the inundation zone; engineered slope designs for stability; replacement of topsoil in gently sloping excavated areas; reseeding and replanting of disturbed areas; and drainage control structures around easily erodible surfaces.

Cañada Reservoir

The impacts and mitigation measures for The Cañada Reservoir alternative would be essentially the same as described for the 24 NLP alternative.

Desalination and No Project Alternatives

Construction of the desalination facility could result in temporary unstable earth conditions associated with excavation in areas of saturated soils and sands, and could increase erosion or compaction of soils as well as beach sands. Pipelines would be vulnerable near earthquake faults or subsidence and liquefaction areas. Mitigation measures to reduce these adverse effects include proper construction techniques, geotechnical assessments prior to construction, and hazard reduction measures. There would be no geologic effects associated with the No Project alternative.

S.7.2 HYDROLOGY AND WATER QUALITY

The hydrology and water quality analysis found in Chapter 7 of the SD EIR/EIS-II focuses on the impacts of project alternatives on five elements: (1) streamflow, (2) aquifer storage, (3) flow frequency and channel geometry, and (4) sediment transport and channel stability, and (5) water quality as it relates to fish and aquatic life. The hydrologic analysis is based on computer simulations for the period 1902 through 1991, assuming a buildout demand of 22,750 AF Cal-Am annual production. It should be noted that all project simulations assume conjunctive operation with the two existing Carmel River reservoirs (where applicable) in addition to existing and anticipated Cal-Am municipal wells.

24,000 AF New Los Padres Reservoir (24 NLP)

Streamflow and Aquifer Storage. Carmel River streamflow and aquifer storage with the 24 NLP alternative would substantially improve the existing situation, especially in dry years. (Presently, the lower Carmel River goes dry during the summer and fall of all but the wettest rainfall years, and may cease flowing for most of the year in droughts; aquifer storage is similarly reduced.) With 24 NLP, year-round streamflow to the lagoon would occur in most years (about 75 percent), and aquifer storage in Carmel Valley would remain high. The Seaside Coastal subbasin would not be affected significantly; on rare occasions, storage would be reduced to very low levels during extended, severe droughts. Monitoring of aquifer water quality and reduced pumping if a risk of seawater intrusion is evident would preclude any adverse effects.

Carmel River Channel. The flow regime from the 24 NLP would foster riparian vegetation growth which would stabilize the river banks. However, vegetation would tend to narrow the channel and may result in potentially significant increases to flood elevations. The reservoir's ability to reduce

peak flows in moderate storms would reduce sediment transport in certain years. The accumulated sediment could potentially impact fish habitat and the Carmel River lagoon, and cause bank erosion in some areas. There would be no measurable impacts to the Carmel River State Beach. All of the potentially significant impacts noted above could be reduced to a less than significant level through mitigation measures such as (1) establish pre-project baseline conditions, using aerial photographs and surveys of channel cross sections, (2) monitor over several years to determine whether adverse changes are occurring, and (3) perform maintenance activities such as vegetation clearing and sediment removal, if needed.

Water Quality. If improperly managed, high water temperatures or low oxygen levels of water released from the reservoir could adversely affect fish and other aquatic life residing downstream of the dam; these creatures are sensitive to small changes in water quality. These impacts could be avoided or reduced to a less than significant level by proper operations which use multiple outlet valves and aeration devices. In fact, the 24 NLP reservoir would have a beneficial effect on water temperatures for steelhead. Project construction could affect water quality (e.g., turbidity); proper construction techniques and control plans would reduce impacts to a less than significant level. Potable water quality for human consumption is addressed in Section S.7.10.

24,000 AF New Los Padres Reservoir/Desalination (24 NLP/D)

The benefits and impacts of the 24 NLP/D alternative would be similar to those of 24 NLP, except there would be improved streamflow and aquifer storage in dry and critically dry years. Brine would be discharged into the Pacific Ocean during the operation of the desalination plant, but the effects would be less than significant. Operation of the Ranney Collectors would not significantly affect groundwater hydrology.

15,000 AF Cañada Reservoir/Desalination (15 CAN/D)

The 15 CAN/D alternative would result in unavoidable adverse effects similar to the No Project alternative in terms of streamflow, though there would be some improvement in certain cases. Aquifer storage in Carmel Valley would remain high, similar to 24 NLP, and would be beneficial. This is the only alternative that would have potentially unavoidable significant adverse impacts to the Seaside Coastal subbasin, as groundwater storage would be depleted more often than with other alternatives.

Flow patterns would be similar to the existing situation, and impacts to channel capacity and sediment transport above the diversion point would be less than significant. However, there could be potentially significant impacts to steelhead migration and channel stability resulting from sediment buildup directly downstream of the diversion point under certain flow regimes. This impact could be mitigated by operation changes such as temporarily stopping diversions during high flows to allow natural flushing or sediment removal, but such measures could reduce project yield for water supply. This alternative would not entail the water quality impacts associated with the 24 NLP reservoir because no water would be released from the Cañada Reservoir to the Carmel River.

7 MGD Desalination Plant (7 DSL)

The 7 DSL alternative would result in unavoidable, chronic periods of inadequate or discontinuous streamflow, similar to the existing situation. However, impacts to Carmel Valley and Seaside aquifer storage would be less than significant and beneficial, respectively. This dichotomy occurs because production from the desalination facilities would reduce the groundwater pumping needed in Carmel Valley and Seaside to some degree, but not enough to restore streamflow in the Carmel River or alleviate chronic, adverse effects of pumping on riparian vegetation in Carmel Valley. Because flow patterns would be similar to the existing situation, impacts to channel capacity and sediment transport would be less than significant. However, river banks may be less stable due to a lack of riparian vegetation. Brine would be discharged into the Pacific Ocean during the operation of the desalination plant; impacts of brine discharge through the MRWPCA outfall could be significant at high concentrations.

No Project (NO PRJ)

The No Project alternative would result in intermittent or inadequate Carmel River flow for five to 11 months each year (depending on the year type), an unavoidable significant adverse effect. Aquifer storage in Carmel Valley and Seaside would be nearly the same as the existing situation. Because flow patterns would be similar to the existing situation, impacts to channel capacity and sediment transport would be less than significant. However, river banks may be less stable due to a lack of riparian vegetation.

S.7.3 FISH AND AQUATIC LIFE

Chapter 8 of the SD EIR/EIS-II examines in detail the impact of water supply alternatives on four key elements that would affect Carmel River steelhead population. They include: (1) inundation or blockage of spawning and rearing habitat; (2) impacts of the flow regime resulting from the operation of alternatives, in conjunction with the Cal-Am system, on the steelhead life cycle -- upstream migration, spawning habitat, juvenile rearing, fall/winter downstream migration and spring emigration; (3) facility and streamflow effects on upstream and downstream fish passage at dams on the Carmel River and (4) operation effects on Carmel River water temperature.

In all cases, the significance of an impact was determined based on simulated "natural" conditions, or what the streamflow patterns in the Carmel River were probably like in pre-European settlement times. The natural condition standard was selected because (1) flow conditions similar to the natural situation would support a healthy, stable steelhead population, and (2) the Water Allocation Program EIR showed that existing conditions result in significant adverse effects to the steelhead population.[2] Some alternatives that would improve the existing or No Project conditions are nevertheless identified as having a significant adverse impact; this is because the minor or moderate improvements would *still result in an overall adverse effect* as compared with the simulated "natural" conditions.

<u>24,000 AF New Los Padres Reservoir (24 NLP)</u>

<u>Habitat Inundation.</u> The 24 NLP would inundate or block 12 percent of spawning habitat and 12 to 14 percent of rearing habitat for steelhead in the Carmel Basin. Both effects are considered as significant adverse impacts. Impacts to spawning habitat could be mitigated to a less than significant level through the spawning habitat restoration program described in Appendix 8. Impacts to rearing habitat would be mitigated to a beneficial level by releasing flow from the new reservoir that significantly improves rearing habitat below the dam.

<u>Operation Impacts on Steelhead Life Cycle.</u> Compared to simulated natural conditions, the flow patterns resulting from the 24 NLP alternative would significantly reduce opportunities for upstream migration, but would improve conditions, as compared to the No Project alternative. Additional mitigations such as holding a contingent of spawners at Granite Canyon Marine Laboratory or artificially attracting sea-run adult steelhead are suggested. The mitigated impact is considered to be significant and potentially unavoidable.

Compared to simulated natural conditions, the 24 NLP impact on spawning habitat would be beneficial overall. The new operation schedule for 24 NLP, which establishes minimum flow standards below the new dam and at the Narrows during the winter spawning season, combined with the spawning habitat mitigation plan will fully compensate for the adverse inundation impacts of the 24 NLP reservoir.

Compared to natural conditions, the 24 NLP alternative would beneficially affect juvenile rearing habitat and spring emigration of smolts; no additional mitigation measures would be required. Flows for fall-winter downstream migration would be considered beneficial compared to the existing situation, but adverse compared to simulated natural flows. This dichotomy reflects the degraded situation that presently exists in the Carmel River. The significant adverse effect can be mitigated to a less than significant level by flow releases and the continuation of a trapping program that is part of the Water Allocation Mitigation Program (See Appendix 2-C).

Fish Passage. Compared to the existing conditions, the small losses of 4 to 7 percent of emigrants that would occur at New Los Padres Reservoir result in a beneficial impact. But compared to natural conditions these losses represent a significant adverse impact. State-of-the-art facilities would replace inadequate facilities at Los Padres Dam, and increased flows would improve passage over San Clemente Dam. If returns of adults to New Los Padres Dam do not increase and the problem is related to the design and operation of the downstream passage facility, additional mitigation may be required.

Water Temperature. The longer duration of cool-water releases would result in beneficial effects to Carmel River water temperature in dry and critically dry years. With careful operations and the multiple level outlet, the water temperatures below New Los Padres Dam should be suitable for all life history phases of steelhead.

24,000 AF New Los Padres Reservoir/Desalination (24 NLP/D)

Impacts and mitigations for the 24 NLP/D alternative would be the same as or similar to all those described for the 24 NLP in the Section above. The addition of a desalination component with this alternative improves performance for several portions of the lifecycle (upstream migration, lower risk of summer and late fall-early winter stranding of juveniles) and provides more flexibility to maintain cool-water releases below Los Padres Dam.

15,000 AF Cañada Reservoir/Desalination (15 CAN/D)

Habitat Inundation. No spawning or rearing habitat would be inundated by the 15 CAN/D alternative. Although no mitigation for inundation is required, the implementation of a spawning gravel maintenance program would be beneficial compared to existing channel conditions.

Operation Impacts on Steelhead Life Cycle. Compared to simulated natural conditions, the 15 CAN/D would result in significant adverse impacts to several stages of the steelhead life cycle, including upstream migration, spawning, the risk of stranding juveniles during summer, fall-winter downstream migration and spring smolt emigration. (There would be localized effects that would be similar or beneficial compared to the existing situation.) All of these impacts could be reduced to a less than significant level with the Water Allocation Mitigation Program efforts described previously, with one exception: the impact to upstream migration would be an unavoidable significant impact because the 15 CAN/D entails no flow releases into the Carmel River. Mitigating these impacts to less than significant levels would require intensive rescue, rearing, and transport activities in the lower Carmel River. Since 15 CAN/D operations do not include augmentation of streamflow in the lower river, it may be impossible to avoid intensive rescue efforts similar to existing conditions.

Fish Passage and Water Temperature. The 15 CAN/D operation would adversely affect fish passage, compared to natural conditions. Conditions would be similar or slightly improved compared to the existing situation, but may still produce migration delays due to lack of flow and inadequate facilities at Los Padres Dam. All adverse impacts could be reduced with improvements to facilities, but probably not to a less than significant level.

The temperature regime would be similar to the No Project alternative situation.

7 MGD Desalination Project (7 DSL)

Impacts and mitigations with the 7 DSL alternative would be similar to those described for the 15 CAN/D alternative above.

No Project (NO PRJ)

Impacts and mitigations with the No Project alternative would be similar to the 15 CAN/D alternative described above.

Impacts of Desalination Plants on Marine Resources

The 3 MGD and 4 MGD desalination plants would discharge brine effluent or cleaning substances into Monterey Bay, either through the ocean floor near Sand City or through the MRWPCA outfall, respectively. The effects would be less than significant for the 3 MGD plant, based on computer modeling and bioassays of local species that would be affected. With the 4 MGD plant, there could be an adverse effect to the tube-worm community in the immediate vicinity of the MRWPCA outfall if high levels of wastewater reclamation occur. The effect would be less than significant due to the abundance of this community and the restricted zone of impact. Please see Section 8.5 for a detailed discussion.

S.7.4 VEGETATION AND TERRESTRIAL WILDLIFE

Chapter 9 of the SD EIR/EIS-II examined the effects of the alternatives on the vegetation and wildlife resources of the project areas, focusing on sensitive habitats (such as riparian) and species.

24,000 AF New Los Padres Reservoir (24 NLP)

The 24 NLP reservoir would inundate about 166 acres of upland habitat, 39 acres of riparian habitat, seven acres of valley oak woodland, two acres of marsh and five sensitive plant or animal species. The upland impact would be less than significant due to its lesser value and abundance in the region. The riparian impact would be significant, but could be mitigated to a less than significant level by restoration and enhancement of 50 acres at Garland Ranch Regional Park. The loss of valley oak woodland would be a significant adverse impact that could be mitigated to a less than significant level by restoration and enhancement of 22 adjacent acres. The 24 NLP alternative would have a beneficial effect on about 115 acres of riparian vegetation in lower Carmel Valley due to year-round streamflow and high groundwater levels in most years. However, plant stress would occur due to groundwater drawdown in droughts with the 24 NLP alternative; this adverse effect could potentially be mitigated by irrigation activities.

The marsh impact would be less than significant because sediment buildup at the upper end of the new reservoir is expected to result in a similar habitat; back-up mitigation measures include a sediment trap and a planting program. It should be noted that the Carmel River Lagoon and Wetland and an existing marsh at San Clemente Dam would benefit from increased flows as would stream-associated riparian wildlife in the lower Carmel Valley. Impacts to the sensitive species would

be less than significant because the reservoir would not pose a threat to their continued existence in the region.

24,000 AF New Los Padres Reservoir/Desalination (24 NLP/D)

The 24 NLP/D alternative would have essentially the same benefits and impacts as the 24 NLP alternative, except that there would be impacts associated with the 3 MGD desalination plant in Sand City. The project could involve take of snowy plover nesting habitat or the black legless lizard. Adverse impacts could be avoided by restricting construction during the plover nesting season, and restoring all disturbed beaches and dune areas, including revegetation with native species.

15,000 AF Cañada Reservoir/Desalination (15 CAN/D)

The 15 CAN/D reservoir would inundate 200 acres of upland habitat, less than one acre of riparian and marsh habitat, and four sensitive plant or wildlife species. Impacts would be considered less than significant for similar reasons enumerated for the 24 NLP alternative. The 15 CAN/D alternative would beneficially affect about 115 acres of lower Carmel Valley riparian vegetation in most years, due to higher groundwater levels than the No Project situation, but would result in plant stress during droughts. Because streamflow would be absent for parts of each year, there would not be the same benefits to stream-associated riparian wildlife as described for the 24 NLP alternative. The desalination impacts would be the same as those described for the 24 NLP/D alternative.

7 MGD Desalination Plant (7 DSL)

The site-specific desalination plant impacts would entail those described above for the 24 NLP/D alternative. In addition, impacts associated with the 4 MGD project in Marina, particularly the numerous miles of pipelines, could include impacts to several sensitive or federally listed plant species, and the Smith's blue butterfly. Efforts would be made to route pipelines away from sensitive habitats. Similar to the No Project alternative, the downstream conditions resulting from the 7 DSL alternative operated in conjunction with the Cal-Am system would result in a potentially unavoidable significant impact to about 110-120 acres of riparian vegetation in normal and dry years, due to chronic groundwater drawdown.

No Project (NO PRJ)

The No Project alternative would not result in the direct loss of plant communities and wildlife habitats due to construction activities. However, the chronic groundwater drawdown resulting from the No Project alternative would result in a potentially unavoidable significant impact to about 110-120 acres of riparian vegetation in lower Carmel Valley in normal and critically dry years, respectively. Studies in 1992 estimated that there would be a 15 to 17 percent loss in riparian wildlife species diversity due to the lack of streamflow in the lower Carmel River.

S.7.5 TRAFFIC

The traffic analysis found in Chapter 10 of the SD EIR/EIS-II examines the direct effects of the operation and construction of each alternative on the existing road network. Refer to Section S.7.13 or Chapter 19 of the SD EIR/EIS-II for information on the indirect traffic impacts of growth allowed by the water supply alternatives.

Reservoir Alternatives

Each reservoir project would result in a less than significant long-term increase in traffic levels as a result of routine project maintenance and operation. Reservoir construction would result in an unavoidable significant adverse effect to traffic due to additional truck and vehicular trips that could not be reduced by carpooling, work camps, offpeak transportation periods and other mitigation measures. About 40 truck trips per day on Carmel Valley Road and Cachagua Road, and up to 125 workers per shift would be expected for 20 to 24 months for the mainstem reservoir projects. The Cañada Reservoir alternative would result in substantially greater impacts, with 190 truck trips per day, six days per week, over a period of three years to import material for the embankment dam via Highway 68.

Heavy trucks needed for reservoir construction could also damage roadbeds in the vicinity of the New Los Padres or Cañada Reservoir projects. Damage to the roadbed caused by the passage of construction vehicles would be repaired.

3 MGD and 7 MGD Desalination Plants

Operation and maintenance of a desalination plant is expected to have a less than significant impact on traffic, but project construction would have temporary adverse effects.

No Project

The No Project alternative would have less than significant traffic impacts during construction and maintenance of new municipal wells.

S.7.6 CLIMATE AND AIR QUALITY

The climate and air quality analysis found in Chapter 11 of the SD EIR/EIS-II examines the direct effects that operation and construction of the alternative water supply projects would have on climate as well as local and regional air quality. A related issue is the project energy consumption, which is discussed in Section S.7.11 and Chapter 16. Refer to Section S.7.13 or Chapter 19 for information on the indirect air quality impacts of growth allowed by the water supply alternatives.

Reservoir Alternatives

Each reservoir project would result in a less than significant long-term increase in traffic-related air pollutant emissions as a result of routine project maintenance and operation. Each would exert a less than significant moderating influence on temperature in the immediate vicinity of the reservoir. Reservoir construction would result in an unavoidable significant adverse effect to air quality. Factors include direct emissions generated by smoke from burning during reservoir clearing and grubbing, exhaust emissions generated by vehicles and construction equipment, and emissions from fugitive dust generated by various construction activities. Measures such as traffic trip reduction, dust abatement, good vehicle maintenance and alternatives to burning would help reduce impacts, but they would remain significant during the construction period for each reservoir.

3 MGD and 7 MGD Desalination Plants

Operation and maintenance of a desalination plant is expected to result in less than significant traffic-related air pollutant emissions. The high energy consumption would contribute to regional air quality degradation due to emissions from electrical generating facilities. The desalination plant is presently inconsistent with the 1991 Air Quality Management Plan, but could be incorporated into future plans.

No Project

The No Project alternative would have less than significant air quality impacts during construction and maintenance of new municipal wells.

S.7.7 NOISE

The noise analysis found in Chapter 12 of the SD EIR/EIS-II examines the effects of operation and construction of alternative water supply projects on noise in the vicinity of the project sites.

Reservoir Alternatives

Noise levels in the vicinity of the dam sites and along transportation corridors accessing the sites would be basically unaffected as a result of routine maintenance and operation. During construction, traffic noise levels along transportation corridors accessing the project site would increase slightly (less than 3 decibels), which is a less than significant impact. However, noise from blasting, rock crushing and other on-site activities would be considered as an unavoidable significant adverse effect to nearby receptors. Residents in the Cachagua area would be affected by the New Los Padres alternatives. Carmel Valley residents would be affected by the Cañada Reservoir alternative. Noise from the Cañada Project diversion facility could be adverse, but proper acoustical design would reduce this impact to a less than significant level.

3 MGD and 7 MGD Desalination Plants

Operation and maintenance of a desalination plant could result in potentially adverse effects due to continuous mechanical noise generated by pumps and other equipment. However, mitigation measures such as proper acoustical design to meet compatibility standards for adjacent land uses would reduce noise impacts to a less than significant level. The noise impacts during construction would be significant and unavoidable.

No Project

The No Project alternative would have less than significant noise impacts during construction and maintenance of new municipal wells.

S.7.8 VISUAL QUALITY

The visual quality analysis found in Chapter 13 of the SD EIR/EIS-II examines the effects of the water supply alternatives on visual resources of the project areas when viewed from public vantages. In addition, the visual impact on the lower Carmel River and Lagoon resulting from streamflow and riparian changes due to project operation are addressed. In all cases, project construction would have temporary adverse visual impacts, but revegetation of disturbed areas would reduce the impact to a less than significant level.

Reservoir Alternatives

The visual impacts for all reservoir alternatives are considered as less than significant, despite their size, because all sites are in remote areas with limited or no public access. The New Los Padres project would inundate an existing reservoir, thus resulting in a similar visual effect. The Cañada Reservoir diversion facility would be seen from Carmel Valley Road, but the impact could be reduced by extensive landscaping and suitable architectural design.

Only the mainstem reservoir projects (24 NLP and 24 NLP/D) would result in beneficial visual effects in the lower Carmel River due to operations that provide year-round flow into the Lagoon in most years. The remaining alternatives would result in a dry river bed and reduced Lagoon volume in summer and fall, which is considered an adverse visual effect.

3 MGD Desalination Plant and 7 MGD Alternative

The 7 MGD desalination alternative and the 3 MGD plant that is combined with some reservoir projects would result in a less than significant impact to visual resources. The 3 MGD desalination project site would be located at an existing warehouse; the 4 MGD site would be located at a regional wastewater treatment plant. Radial wells and pipelines would be buried.

No Project

The No Project alternative would have less than significant impact on visual resources during construction and operation of new municipal wells.

S.7.9 CULTURAL RESOURCES

The cultural resources analysis found in Chapter 14 of the SD EIR/EIS-II evaluated the historic and prehistoric cultural resources of the areas that could be affected by the alternative water supply projects. Any construction project that involves earthmoving has the potential to unearth previously undiscovered cultural resources. All earthmoving activities would cease in the event that cultural resources are unearthed, and an archaeologist would be retained to evaluate the findings.

New Los Padres Reservoir (24 NLP, 24 NLP/D)

The 24,000 AF New Los Padres Reservoir would be located in an area traditionally in the domain of the Esselen Tribe. The reservoir would inundate 13 archaeological sites (bedrock mortars) recommended for federal listing in the National Register of Historic Places, which would be considered a significant adverse impact. Five traditional cultural properties (sacred sites or culturally important areas) recommended as eligible for federal listing would be affected by the 24 NLP reservoir. Mitigation measures such as a Cultural Resources Mitigation Plan, thorough investigation of archaeological sites, support for cultural revitalization efforts of the Esselen Tribe, avoidance of impacts (where possible) and providing Esselen access to conduct traditional activities would reduce impacts to a less than significant level. Two historical sites affected by the project are not recommended as eligible, and the effect would be less than significant.

15,000 AF Cañada Reservoir/Desalination (15 CAN/D)

Two recorded cultural resources that could be affected by this alternative were not located during reconnaissance surveys, but there exists a relatively high probability of them being encountered. This impact is considered as potentially significant. An archaeological monitor should be present during all construction activities.

3 MGD and 7 MGD Desalination Plant (7 DSL)

No known cultural resources would be affected by either a 3 MGD or 7 MGD desalination plant.

No Project (NO PRJ)

The No Project alternative would have no impact to cultural resources.

S.7.10 PUBLIC HEALTH AND SAFETY

The public health and safety analysis in Chapter 15 of the SD EIR/EIS-II evaluated the potential effects to public health and safety that could result from the alternative water supply projects. The areas examined include dam failure, increased flood risk, and potable water quality.

Reservoir Alternatives

Each of the proposed reservoirs would pose similar risks to public health and safety. Dam failure would result in the inundation of private property and the potential loss of human life; proper design and construction techniques which comply with Division of Safety of Dams standards would reduce the risk of failure to a less than significant level. The Carmel River channel below a New Los Padres Dam could narrow by varying degrees as a result of reservoir operations; continuing monitoring and channel maintenance would reduce the potential for increased flood elevations to a less than significant level. Establishment of riparian vegetation in the lower river due to improved streamflow with the 24 NLP alternatives would reduce the risk of bank erosion and property damage. The potable water quality that would be provided by the proposed reservoirs is expected to be of good quality, and would be treated to meet or exceed all applicable water quality standards.

Dam construction could pose a threat to worker and public health and safety, but could be mitigated to a level of insignificance by implementation of rigorous safety procedures, fire prevention techniques, proper storage of materials, traffic safety and proper security.

Desalination Alternatives

Desalinated ocean water would be expected to meet all applicable water quality standards, and have no adverse effects on public health. Construction safety measures would be similar to those for the reservoir projects.

No Project

The No Project alternative would have no direct impacts to public health and safety. However, it should be noted that Health Department posting of unsafe conditions for human contact with Carmel River and Lagoon waters as well as property damage in storms due to bank erosion will continue with the No Project alternative. These conditions stem from a chronic lack of streamflow.

S.7.11 ENERGY

As described in Chapter 16 of the SD EIR/EIS-II, both the operation and construction of the project alternatives would consume energy. The highest operational energy-consuming alternatives are those associated with desalination and pumped storage. Though energy use would be high, there would be a less than significant impact because adequate electrical generating capacity exists to meet demand. The lowest energy-consuming alternatives would be the 24 NLP and the No Project, which would consume a minimal amount of energy for operations.

Project construction would consume a considerable amount of energy, the highest of which would be the 15 CAN/D alternative, considered to have an unavoidable significant impact during its construction because of the large amount of earthen materials that would need to be transported to the site by truck, as well as the duration of construction. The remaining alternatives would all consume substantially less energy (about one-ninth that of 15 CAN/D), which would be considered a less than significant impact.

S.7.12 LAND USE, PLANNING AND RECREATION

The land use, planning and recreation analysis found in Chapter 17 of the SD EIR/EIS-II evaluates the compatibility of the water supply project alternatives with the local land use plans and policies. Appendix 17 provides a detailed Policy Consistency Analysis. The recreational effects are evaluated both at the project site and in the lower Carmel River, based on streamflow patterns resulting from each alternative.

<u>New Los Padres Reservoir (24 NLP, 24 NLP/D)</u>

A reservoir at this site would be generally consistent with applicable land use plans. The 24,000 AF reservoir would affect up to 23 acres of the Ventana Wilderness, but this adverse effect would be mitigated to a less than significant level by a 140-acre land exchange approved by Congress in 1990. Existing campsites along trails leading to another area of the Ventana Wilderness would be inundated by the 24 NLP, but similar facilities would be provided. River-based recreation in the lower Carmel River and Lagoon would be enhanced by the year-round flows with the 24 NLP and 24 NLP/D projects; the public would benefit from the increased amount of public land that would be available for recreational opportunities adjacent to the reservoir.

15,000 AF Cañada Reservoir/Desalination (25 CAN/D)

The 15 CAN/D alternative is generally consistent with its land use designation; however, a residential development has been proposed for this area, and a new home has been built adjacent to the diversion site. The project would have a beneficial effect on recreation in the area due to increased amounts of public land available. However, river-based recreation would be adversely impacted due to a lack of streamflow for several months in many years.

7 MGD Desalination Plant (7 DSL)

The 7 DSL alternative would have a less than significant effect on land use and planning. This alternative would have no direct impact on recreation, but river-based activities would be adversely affected due to the lack of streamflow for several months each year.

No Project (NO PRJ)

The No Project alternative would not be expected to have any significant land use impacts, and there would be no direct impacts on recreation associated with this alternative. However, river-based recreation would be adversely affected due to the lack of streamflow for several months each year.

S.7.13 POTENTIAL FOR GROWTH INDUCEMENT; EFFECTS OF PLANNED GROWTH

As discussed in Chapter 19 of the SD EIR/EIS-II, restriction of the Peninsula water supply has demonstrably constrained residential and commercial growth of the area. Increasing water supply would enable growth that could not otherwise occur. By statutory and judicial interpretation of the term, these effects would be growth inducing. Evidence discussed in Chapter 19 indicates that the scale of growth fostered by the long-term water supply alternatives would be significant, and, with respect to transportation and air quality, indirect effects of population growth accommodated by the alternatives would be adverse. Although the District is not a land use or resource regulatory agency, District cooperation with such agencies could help to mitigate such adverse effects to less than significant levels.

Water supply is only one of many factors which must combine to foster growth in any particular area. Other factors like the availability of properly zoned land; sufficient wastewater treatment, roads, schools and public safety services; and a pleasant climate can all affect a region's growth rate. Market forces and community development policies are probably the two most important factors causing (or

restraining) growth. Because market forces are difficult to predict, the District bases capital planning on buildout assumptions expressed in general plan and zoning documents of local governments within its jurisdiction; once plans are adopted by a community, the MPWMD perceives its responsibility to respond to the community's desires as expressed in the general plan.

The basic purpose of each alternative analyzed in this SD EIR/EIS-II is to meet the Monterey Peninsula's projected municipal water demand at buildout, defined as normal year Cal-Am production of 22,750 AF. (One exception is the No Project alternative, which limits Cal-Am production to 17,359 AF annually.) The water demand estimates are based on population and employment projections that are consistent with present land use plans. To that extent, these alternatives foster, or induce growth by removing the water supply constraints to growth. (Even the No Project alternative would induce growth because it would enable growth in excess of present levels.)

Although designed to accommodate buildout population levels, the District must allocate new water sources at a rate consistent with population projections contained in the 1991 Air Quality Management Plan (AQMP) (see Chapter 4). The District may also be called upon to coordinate allocations consistent with the County-wide Congestion Management Plans now under development. Allocation limits and phasing would be part of the project voted on by the public.

Impacts of Planned Growth

As described in Chapter 19 of this SD EIR/EIS-II, the planned growth allowed by long-term water supply alternatives would significantly reduce the level of service on local roads and highways. Funding for needed road improvements may not be secured in a timely manner unless steps are taken in the near future. The County Congestion Management Plan is intended to assure comprehensive planning to assure maintenance of adequate service levels.

Increased traffic and/or congestion would also increase traffic-related air pollutant emissions. Population growth would also increase emissions from power generating facilities and other cumulatively significant stationary sources associated with new homes and businesses. While population increase supported by the water supply alternatives appears consistent with the 1991 AQMP (indicating that the projects would be consistent with the AQMP), measures to assure timely attainment of State and federal air quality standards have yet to be identified by the Monterey Bay Unified Air Pollution Control District. Therefore despite consistency with the AQMP, growth

supported by the water supply alternatives could still contribute to significant air quality impacts. This potential supports a policy of continued allocation of water by the District in coordination with population increases allowed for in the AQMP (and such AQMP amendments as may be adopted in the future). It may also support coordination of allocations with the land use element of the County Congestion Management Plan.

The majority of Peninsula schools will be able to serve the needs of estimated buildout populations without significant financial outlay. The same is true for regional solid waste and wastewater facilities, which appear to have adequate funding mechanisms in place.

The character of the Monterey Peninsula could change if maximum growth allowed by the General Plans occurs. The commercial sector could grow over two times as fast as the residential sector; multifamily units could dominate in the residential sector, except in unincorporated areas of the County. There would be increased urbanization and congestion, and increased incommuting from areas outside of the District.

The fiscal balance of all cities, except Sand City and Pacific Grove, is likely to improve over the current situation due to relatively high levels of employment growth in relation to housing growth. Since Marina and Salinas may provide the labor force (and housing) for Peninsula employees, their fiscal health may be impacted. [Note: these conclusions may change if Fort Ord's closure is considered].

Most mitigation measures for the above impacts cannot be implemented by MPWMD. Measures within the scope of MPWMD's authority include: (1) phasing allocation of water to be consistent with Air Quality Management Plans, (2) consider coordinating the phasing of allocated water with development of traffic infrastructure to help meet the goals of the Traffic Congestion Management Plan and (3) support efforts to coordinate infrastructure and land use planning on County and regional levels.

S.8 ENVIRONMENTALLY SUPERIOR, ENVIRONMENTALLY PREFERABLE FEASIBLE, AND OVERALL PREFERRED ALTERNATIVES

S.8.1 ENVIRONMENTALLY SUPERIOR ALTERNATIVE (CEQA)

The California Environmental Quality Act (CEQA) requires that an EIR describe and compare the impacts of a range of reasonable alternatives to the proposed project which could feasibly attain the basic objectives of the project (CEQA Guidelines, Section 15126-D). "Feasible" is defined as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social and technological factors (CEQA Guidelines, Section 15364). An EIR must identify the "environmentally superior" alternative, and discuss alternatives that could eliminate any significant adverse effects of the proposed project, even if that alternative would be more costly or impede the attainment of project objectives. However, additional adverse effects caused by the alternatives must also be discussed.

In August 1992, the State Water Resources Control Board (SWRCB) began five days of hearings on complaints against the California-American Water Company (Cal-Am). Complainants alleged that Cal-Am is illegally diverting underflow of the Carmel River, and that existing water supply practices are adversely affecting the public trust resources of the Carmel River. Extensive written and oral testimony from public agencies and complainants presented at the hearings, as well as subsequent communications with SWRCB staff, form an important basis for the determinations in this document.

Two dominant themes emerged from the SWRCB hearings -- (1) the existing (No Project) situation on the Carmel River is unacceptable, significant and adverse in the view of responsible agencies such as the California Department of Fish and Game, environmental groups, and members of the public; and (2) streamflow from a project such as the proposed New Los Padres Reservoir is the only feasible long-term solution to correct the existing damage to fishery and riparian habitat, and provide adequate instream flows to protect the public trust resources of the Carmel River.

Determination

Based on the testimony and evidence presented at the SWRCB hearings,[3] data provided in the MPWMD Water Allocation Program EIR,[4] and information contained in this document, it is evident that the No Project alternative is not the environmentally superior alternative. All factors considered, the **24,000 AF New Los Padres Reservoir** with or without desalination is identified as the

environmentally superior alternative under CEQA. Reasons for this selection include: (1) only the two 24 NLP reservoir alternatives would correct existing damage in the lower Carmel River and provide adequate instream flows for public trust resources in nearly all years; (2) the two 24 NLP alternatives would provide the greatest benefit to the steelhead resource (in some cases, exceeding "natural" conditions), stream-associated riparian wildlife, lagoon habitat and wildlife, water-dependent recreation and aesthetics; and (3) inundation impacts could be mitigated to a less than significant (and in some cases, beneficial) level.

In terms of environmental superiority, the choice between the two 24 NLP alternatives is difficult due to their similarity. The 24 NLP alternative (without desalination) entails the least energy use of all long-term alternatives and would not entail mitigation measures for the few significant adverse effects identified in the Near-Term Desalination Project Final EIR. However, the production from the 3 MGD desalination plant would result in improved instream flows, reservoir storage and aquifer storage in certain drought years, which would benefit aquatic life during those crucial periods.

The 15 CAN/D alternative would entail extensive upland inundation impacts, construction impacts (particularly traffic) and energy use, and would not provide instream flows needed to sustain the public trust resources. The 7 DSL alternative would result in continued, unacceptable dewatering of the Carmel River, similar to the No Project situation, in order to meet municipal demand. The 7 DSL alternative would not entail inundation impacts, but habitat for listed species could be affected by pipeline construction, and the energy use would be substantial (equivalent to the annual use of 5,900 residential customers). As noted above, the No Project alternative results in chronic, unacceptable adverse effects to the public trust resources of the Carmel River.

S.8.2 ENVIRONMENTALLY PREFERABLE FEASIBLE ALTERNATIVE

The environmentally preferable feasible alternative is a federal definition that refers to the practicable alternative that would have the least environmental consequences prior to mitigation. The Clean Water Act, Section 404(b)(1) Guidelines defines "practicable" as "available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes."

In the 404 Permit application, the basic project purpose is defined as "(a) provide water supply for increased drought protection for existing and future users, and (b) meet projected municipal demand

associated with planned growth within [the MPWMD]." The District Board has set a goal to have no more than a 10 percent shortage in any year, which corresponds to "voluntary" rationing. The overall project purpose is to provide adequate instream flow to protect the public trust resources of the Carmel River.

Based on an analysis conducted in January 1993 in accordance with the Clean Water Act, Section 404(b)(1) Compliance Evaluation (on file in the U.S. Army Corps of Engineers' San Francisco District office), only two of the five alternatives analyzed in this SD EIR/EIS-II are considered to be practicable -- the 24 NLP and 24 NLP/D alternatives. The remaining alternatives are not considered to be practicable because they either fail to meet the water supply purpose, are too costly, entail serious technical concerns, are constrained by logistical factors, and/or do not meet the 404(b)(1) Guidelines with respect to "other significant adverse environmental consequences." A brief summary of the conclusions of the 404(b)(1) evaluation follows.

Alternatives Considered to be Practicable

24,000 AF New Los Padres Reservoir. The 24 NLP alternative is considered to be practicable as it would provide water supply and drought protection for existing users and planned growth, though not to the same level of performance as the 24 NLP/D alternative. As shown in Summary Tables S-1 and S-2, as well as Section 20.1 above, the 24 NLP alternative (along with the 24 NLP/D project) would result in the greatest pre-mitigation benefits to hydrology (year-round streamflow in most years and higher ground water levels); adequate instream flows to support a healthy steelhead resource in most years; optimum conditions for riparian vegetation and greater species diversity of stream-associated riparian wildlife in most years; enhanced lagoon/wetland habitat; as well as enhanced river-based aesthetic and recreational opportunities. The 24 NLP reservoir would inundate steelhead spawning and rearing habitat, riparian and valley oak woodland habitat, and would have the greatest impact to cultural resources.

24,000 AF New Los Padres Reservoir/3 MGD Desalination. The 24 NLP/D alternative is considered to be practicable as it would provide excellent water supply performance due to the production capacity of the desalination plant in critical periods. This alternative would entail all of the pre-mitigation benefits and impacts enumerated above for the 24 NLP alternative (See Summary Tables S-1 and S-3), but some to a greater degree. For example, the production from the 3 MGD desalination plant would result in a longer duration of adequate instream flows (and greater aquifer

storage) in certain drought years, which would benefit aquatic life during those crucial periods. The presence of the desalination plant is associated with possible site-specific impacts, most of which were determined to be less than significant prior to mitigation. It should be noted that a reservoir smaller than 24,000 AF combined with desalination would not provide the instream flows determined to be necessary by the Interagency Fishery Working Group.

Alternatives Considered Not to be Practicable

15,000 AF Cañada Reservoir/3 MGD Desalination. The 15 CAN/D alternative is considered to be infeasible due to the combined effect of excessive cost (based on 1992 estimates) compared to other alternatives with similar or better water supply performance, and significant uncertainties about true project costs. Uncertainties include the "highly unusual characteristics" of the native rock used to construct the dam[5] and the need to construct a test fill, the feasibility and impacts of the river diversion works, the cost impacts of the extensive dependence on electricity for pumped storage and desalination should power rates increase, and the need to site and build an electrical substation.

The 15 CAN/D alternative would be similar (but would entail some improvement) to the No Project scenario in terms of inadequate instream flows to protect public trust resources, and would entail inundation of native upland habitat. A logistical constraint includes the low probability of voter approval given that the 15 CAN/D alternative would provide 10 percent more simulated firm yield than the 24 NLP project at over three times the cost to the average Cal-Am residential customer. There would also be three years of significant, unavoidable, adverse traffic impacts on Highway 68 (a major link between Salinas and Monterey) for six days per week, 10 hours per day in order to import materials with which to build the dam. This construction impact would be substantially more onerous than with any other alternative.

7 MGD Desalination Plant. The 7 DSL alternative is considered to be infeasible due to the combined effect of excessive cost (based on 1992 estimates) for the benefits received, uncertainties of true water supply performance given SWRCB action that could be taken on the Carmel River, uncertainties about true project costs in the future (should power rates increase) due to a heavy dependence on electricity, and vulnerability to disrupted electric power service (i.e., after a seismic event). The 7 DSL alternative would entail construction of two desalination plants, one of which would be outside the District boundaries.

The 7 DSL alternative would be very similar to the No Project scenario in terms of degradation of public trust resources due to groundwater pumping and inadequate instream flows. A logistical constraint includes the low probability of voter approval given that the 7 DSL alternative would provide 24 percent more simulated firm yield than the 24 NLP project at over 2.6 times the cost to the average Cal-Am residential customer, and still do very little to correct environmental damage on the Carmel River.

It should be noted that the excellent simulated water supply performance of the 7 DSL alternative depends on and assumes very similar levels of diversion and pumping from the Carmel River that exist for the No Project alternative (with similar impacts). It also entails use of the entire 7 MGD production capacity for meeting the demand of future growth; this is a significant departure from the Near-Term Desalination Project, which sets aside 50 percent of desalination production capacity for drought reserve and the environment.

Based on testimony provided at the SWRCB hearings concerning complaints against Cal-Am, it is evident that Cal-Am is diverting underflow from the Carmel River and does not have a permit to do so. (Cal-Am is presently applying for permits to divert underflow through existing wells in Carmel Valley.) SWRCB staff have indicated that if the District does not address the Carmel River problem, then the State would consider more stringent conditions and enforcement actions.[6] Devotion of 50 percent of the Near-Term Desalination Project production to drought reserve/environment was cited as an example of addressing the problem. Thus it is possible that a significant portion of the production from the 7 DSL alternative could not be used to meet the needs of planned growth (or conversely, pumping from Carmel Valley would be limited by SWRCB action). In either case, water supply performance would fall short of that of a practicable alternative.

No Project Alternative. The No Project alternative is not considered to be feasible as it does not meet the basic project purpose of providing adequate drought protection and supply for planned growth. It would result in continued degradation of the Carmel River environment as well.

Determination

Because the 404(b)(1) Guidelines focus on impacts prior to mitigation, the **24,000 AF New Los Padres Reservoir** is identified as the environmentally preferable feasible alternative under NEPA. There would be significant pre-mitigation benefits to the lower Carmel River and public trust

resources in nearly all years (including the steelhead resource, stream-associated riparian wildlife, lagoon habitat and wildlife, water-dependent recreation and aesthetics). The 24 NLP alternative would not entail potential effects to sensitive species, energy use and hydrologic concerns associated with the 3 MGD desalination component of the 24 NLP/D alternative.

An authorizing election is targeted for June 1993 for construction of a 3 MGD Near-Term Desalination Project. If the vote is positive, the District would continue to pursue permits for the 24,000 AF New Los Padres Reservoir as the environmentally preferable feasible alternative. If the desalination project vote is negative, the District would pursue construction of the new dam as a stand-alone alternative. The community could consider a desalination plant in a future year (approximately year 2015) when it may be needed to meet municipal demand estimated at that time.

S.8.3 OVERALL PREFERRED ALTERNATIVE

The overall preferred alternative is the project selected by MPWMD, based on environmental impacts and benefits as well as water supply performance, ccst, reliability, and other factors. The overall preferred alternative need not be identified in a Draft or Supplemental Draft SD EIR/EIS-II, but must be identified in a Final SD EIR/EIS-II.

The overall preferred alternative is identified as the **24,000 AF New Los Padres Reservoir combined with a 3 MGD desalination plant.** Though its cost would be higher than the 24 NLP alternative alone (present worth cost in 1992 dollars of $17.79 versus $8.55 per Cal-Am bill, respectively, for the average residential water user, a difference of $9.24 every two months), this combination would result in the best instream flow conditions that are feasible on the Carmel River and would provide excellent water supply performance in meeting demand estimated to occur with planned growth (buildout). It would be less expensive than infeasible alternatives (15 CAN/D, 7 DSL) that do not perform as well in terms of water supply and/or do not alleviate existing degradation of the lower Carmel River environment. A reservoir smaller than 24,000 AF would not provide sufficient instream flows determined to be necessary by the interagency Fishery Working Group.

It should be noted that construction of the dam first, followed by desalination in approximately the year 2015 would reduce present worth costs to Cal-Am residential customers compared to the reverse sequence (present worth cost in 1992 dollars of $10.98 versus $17.79 per Cal-Am bill, respectively, for the average residential water user, a difference of $6.59 every two months). However, from a

water supply perspective, the immediate need for more secure drought protection and relief from the District-mandated moratorium are reasons to pursue the near-term desalination component as soon as possible, followed by the new dam. An election to authorize proceeding with a near-term desalination project is scheduled for June 8, 1993.

S.9 UNAVOIDABLE SIGNIFICANT ADVERSE IMPACTS

The CEQA guidelines require that significant environmental effects that cannot be avoided must be identified in an EIR. Section 15382 of the CEQA guidelines state that a "significant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. The guidelines also indicate that "an ironclad definition of significant effect is not possible because the significance of an activity may vary with the setting." Because few definitive criteria exist as to what would be considered a "significant" impact, the best professional judgment is used in this SD EIR/EIS-II.

In making the judgment of significance, it was assumed that to be judged "significant and unavoidable," an adverse impact would have to involve a permanent or substantial temporary degradation in the quality of the environment, or the destruction of important natural and cultural resources that cannot be prevented by the incorporation of mitigation measures. Standards of significance are presented throughout the SD EIR/EIS-II, and judgments of significance are presented both before and after mitigation. In some cases, mitigation measures are presented, but impacts would still remain significant and unavoidable. The term "potentially unavoidable" refers to the situation where the suggested mitigation measures can possibly reduce impacts to a less than significant level, but success must be confirmed by additional studies. Table S-1 summarizes the potentially significant and unavoidable (PSU) and significant and unavoidable (SU) impacts for each alternative that would occur with demand at buildout levels (22,750 AF annual Cal-Am production).

S.10 AREAS OF CONTROVERSY

S.10.1 FISH PASSAGE FACILITIES

The probable success of fish passage facilities for mainstem reservoirs on the Carmel River has been a controversial issue for two reasons. First, the preliminary design of the passage facility in the 1987 Draft EIR/EIS relied on a collection facility located on the upstream face of the dam, and it was

unknown whether juvenile steelhead would be able to swim through the reservoir and find the facility. Because of this uncertainty, the preliminary designs for the New Los Padres and New San Clemente alternatives were modified, with the participation of engineers from the National Marine Fisheries Service and the California Department of Fish and Game. The new design would be able to pass fish during nearly all years, except the wettest on record. Juvenile steelhead would be screened from the river at a site located upstream of the reservoir, and transported downstream.

The second area of controversy involves the question of whether steelhead can be successfully transported downstream. In recent years, the Carmel River Steelhead Association and MPWMD staff have rescued and transported thousands of steelhead from the Carmel River with low mortalities.[7] This local experience with fish from the Carmel River and extensive evidence from other rivers where salmonids are transported around blockages indicates that a program to trap and transport juvenile steelhead around New Los Padres Dam will be successful. It should be noted that mortality with the new facilities is expected to be low (4-7 percent) compared to the relatively high mortality (20 percent) currently experienced by smolts as they pass over the existing Los Padres Dam.

S.10.2 SELECTION OF ENVIRONMENTALLY PREFERABLE FEASIBLE ALTERNATIVE

As described in Section S.8.2, the 24,000 AF New Los Padres Reservoir was identified as the environmentally preferable feasible alternative. A choice between the 24 NLP and 24 NLP/D alternatives is difficult due to their similarity. The 24 NLP alternative alone would not entail the impacts (particularly those related to energy use) of the 3 MGD desalination plant. However, the production from the 3 MGD plant would result in improved streamflow in certain critically dry water years, which would benefit the Carmel River environment during those periods. The District believes a substantial body of evidence exists to conclude that the 15 CAN/D and 7 DSL alternatives are not practicable (see S.8.2 above), but this determination could be considered controversial by some individuals.

S.10.3 OVERALL PREFERRED ALTERNATIVE

As described in Section S.8.3, the 24,000 AF New Los Padres Reservoir combined with a 3 MGD desalination plant was identified as the overall preferred alternative. This could be considered controversial as some members of the public advocate the 24 NLP reservoir alone as the best project. The 24 NLP alternative alone would be less costly (see Table S-7), would provide for 20 years of

growth with no greater than a 10 percent shortage in any year, and greatly improve environmental conditions on the Carmel River. The 24 NLP/D combination project would provide adequate supply for the full buildout demand, additionally improve streamflow and aquifer storage in certain critically dry years, and result in greater system flexibility and reliability.

A related area of controversy is the accuracy of the buildout demand estimates as indicators of actual growth that may occur. Some members of the public believe the buildout estimates are inflated, and growth will never achieve allowable maximums. Others believe that the estimates are too low as they do not entail estimates of civilian reuse of Fort Ord.

Another area of controversy, assuming the 24 NLP/D alternative is the preferred project, is the order in which the facilities should be constructed. The District has assumed for planning purposes that the near-term 3 MGD desalination project would be constructed first, followed by the New Los Padres Reservoir. Another possibility is construction of the dam first, followed by desalination in the future year when it is needed.

From a water supply perspective, the need for increased drought protection and water for planned growth are reasons to pursue the desalination component as soon as possible; the community would not have to wait at least six more years for a new water supply from the proposed reservoir. On the other hand, construction of the dam first, followed by desalination in approximately the year 2015, would reduce average costs to Cal-Am residential customers compared to the reverse sequence (see Section S.8.3). Concerns have been expressed that the public will be reluctant to incur the additional cost of a dam subsequent to funding a desalination plant. This controversy may be rendered moot based on the results of a June 1993 election to authorize proceeding with the near-term desalination project.

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1. Final Environmental Impact Report, Water Allocation Program, (SCH 87030309) MPWMD, April 1990.

2. Ibid.

3. Transcripts of SWRCB Hearings, August 24-26, 31 and September 1, 1992; Volumes I-V. Written testimony and exhibits submitted to SWRCB for the above hearings.

4. MPWMD, Final EIR, Water Allocation Program (SCH 87030309), April 1990.

5. Brown and Caldwell Consultants, Cañada Reservoir Project Phase 3 -- Analysis of 15,000 AF Reservoir (draft report); prepared for Cal-Am Water Company, November 1992.

6. MPWMD memorandum by Jim Cofer dated December 17, 1992 describing December 11, 1992 telephone conversation with Steven Herrera of SWRCB.

7. MPWMD, Interim Environmental Relief Program, 1990-1991 Annual Report. July 1991.

1. INTRODUCTION

1. INTRODUCTION

1.1 NEW WATER SUPPLY PROJECT

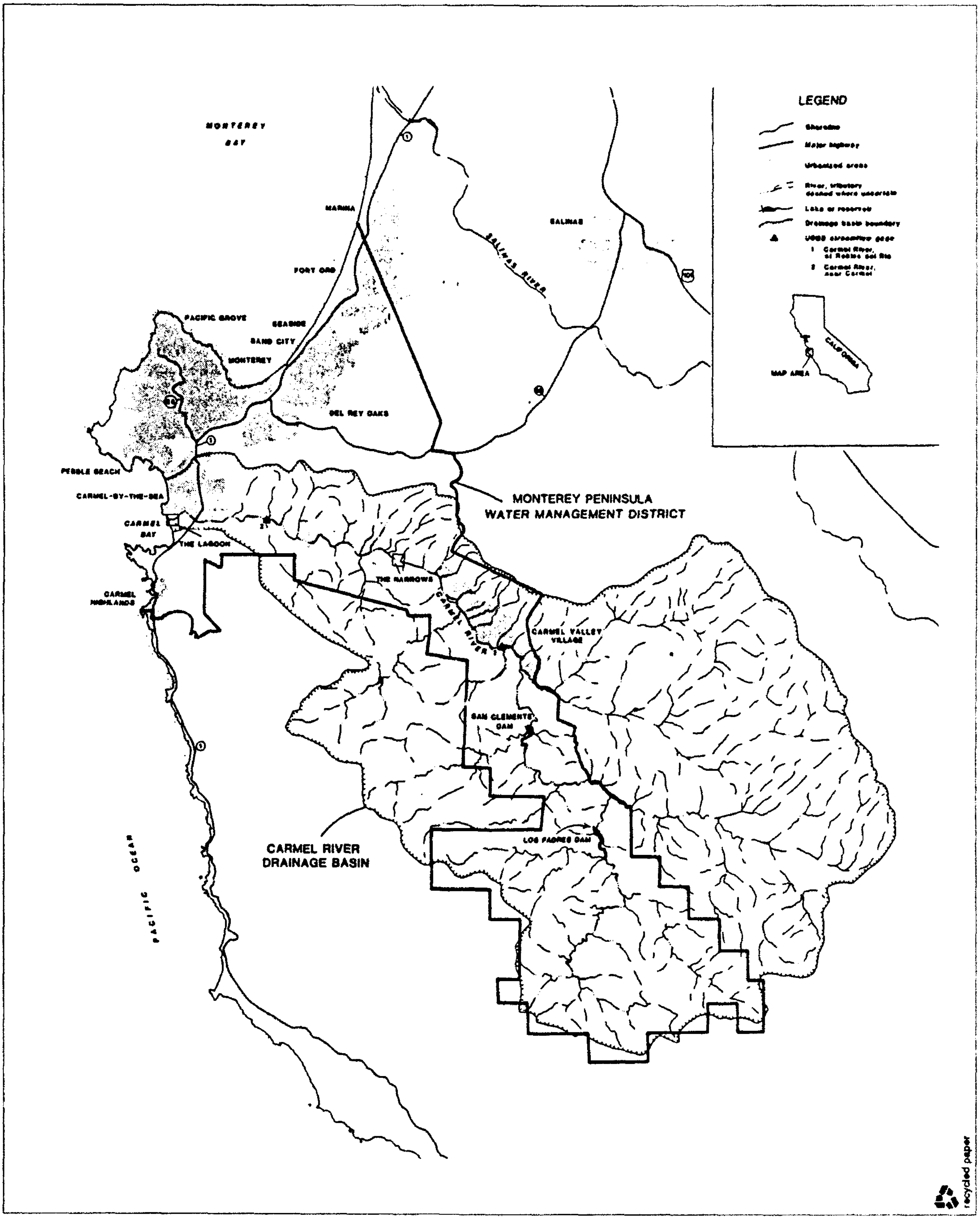
The Monterey Peninsula Water Management District (MPWMD or "the District") was created by the California legislature in 1978. Its creation was prompted by the severe water shortage on the Monterey Peninsula during the drought of 1976 and 1977. The District boundaries encompass the cities of Carmel-by-the-Sea, Del Rey Oaks, Monterey, Pacific Grove, Sand City, Seaside and portions of Marina, Fort Ord and Monterey County, primarily in Carmel Valley (Figure 1-1). The California-American Water Company (Cal-Am) is the primary water purveyor within the District. Two of the District's principal goals are to expand the Peninsula's water supply and to protect and restore the natural resource values of the Carmel River Basin. These goals became increasingly important during the recent 1987-92 drought.

In the early 1980s, District staff and their consultants undertook extensive technical studies designed to improve understanding of the ground and surface water resources available to the District and some of the problems involved in developing them. In 1985 and 1986 the District established criteria that any water supply improvement project would have to meet in order to satisfy the District's needs. A broad range of alternative water supply improvement projects were simulated and examined in detail. Alternatives not meeting the District's criteria were progressively eliminated from further consideration. By the spring of 1987, the District had identified three alternatives that would meet its needs. All three involved construction of a new dam and reservoir on the Carmel River, known as the New San Clemente Dam and Reservoir; new wells in the Seaside Coastal Groundwater Subbasin and the Carmel Valley Aquifer; and expansion of Cal-Am's Begonia Water Treatment Plant. For the purposes of the Clean Water Act, Section 404 Permit ("404 Permit"), the proposed project was identified as a 29,000-acre-foot (AF) dam and reservoir at the New San Clemente site.

The Draft Environmental Impact Report and Statement (EIR/EIS) for the New San Clemente Project was released in September 1987 for public review. Several commentors, including state and

MPWMD BOUNDARIES

FIGURE 1-1



SOURCE: MPWMD

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federal resource agencies, believed that the selection criteria were too restrictive, and that additional alternatives should be analyzed in more detail. In January 1988, the District Board determined that a Supplemental Draft EIR/EIS (SD EIR/EIS) would be prepared and that the alternatives selection process would be repeated. An interagency group was convened to assure a consensus in selecting alternatives for analysis in the SD EIR/EIS. Based on discussions with the interagency group, the District Board determined in March 1989 that the proposed project for the 404 Permit should be changed to a 24,000 AF dam and reservoir at the New Los Padres site.

A multiphase selection process for alternatives was repeated in 1989, and refined as new information was obtained in 1990 and 1991. The worsening drought also led to changes in the project size and components that would be needed to provide adequate supply in the future (see Chapter 3).

Earlier in the alternatives selection process, projects were evaluated based on two basic project purposes that entailed both water supply and river flow performance criteria within a cost limit established by the District. Based on consultation with the Environmental Protection Agency, for the purpose of the 404 Permit, the District Board amended the basic project purpose in August 1990 to include solely drought protection and water supply to meet existing and future needs. This action broadened the scope of alternatives that are analyzed in detail in the Supplemental Draft EIR/EIS. The overall project purpose of instream flow to protect public trust resources of the Carmel River remained as a District goal.

Ten alternatives were analyzed in detail in the SD EIR/EIS, as listed below. They included four mainstem dams, three tributary dams, one off-stream reservoir and two non-dam alternatives as follows:

- 24,000 AF New Los Padres Reservoir (24 NLP)
- 16,000 AF New Los Padres Reservoir plus a 3 million gallon/day (MGD) desalination plant (16 NLP/D)
- 9,000 AF New Los Padres Reservoir plus a 3 MGD desalination plant (9 NLP/D)
- 23,000 AF New San Clemente Reservoir (23 NSC)
- 6,000 AF Cachagua Creek Reservoir plus a 3 MGD desalination plant (6 CAC/D)
- 11,000 AF San Clemente Creek Reservoir with pumped storage (11 SCC)

- 10,500 AF Chupines Creek Reservoir with pumped storage (10 CHU)
- 25,000 AF Cañada Reservoir (25 CAN)
- 7 MGD desalination plant (7 DSL)
- No Project (NO PRJ)

In July 1991, the District prepared a draft 404(b)1 Compliance Evaluation for the U.S. Army Corps of Engineers. This document determined, among other things, which of the 10 alternatives listed above are "practicable" as defined in Section 404 of the Clean Water Act. The 404(b)1 Compliance Evaluation concluded that the three largest Carmel River mainstem reservoirs listed above are practicable because they meet the basic water supply purpose at a reasonable cost. The remaining alternatives are not considered to be practicable because they fail to meet the water supply purpose, are too costly, have questionable site availability and/or are constrained by logistical factors. However, they were analyzed in the SD EIR/EIS at a similar level of detail.

In January 1992, the District Board determined that a second "Supplemental Draft EIR/EIS-II" (SD EIR/EIS-II) would be prepared to respond to concerns expressed in comments on the 1991 document, and to incorporate new information about the New Los Padres Project construction and operations, site-specific impacts of desalination, and changes to the Cañada Reservoir alternative.

In their written comments on the 1991 SD EIR/EIS, state and federal resource agencies requested that the District continue to explore the following alternatives: (1) a 24,000 AF New Los Padres Reservoir combined with a desalination plant, (2) a smaller Cañada Reservoir combined with a desalination plant, and (3) a large, stand-alone desalination plant. Using the District's Carmel Valley Simulation Model (CVSIM), which incorporated revised operation procedures, a rationing protocol, revised water demand estimates and hydrologic information developed in 1992, the following alternatives were selected for analysis in this SD EIR/EIS-II:

- 24,000 AF New Los Padres Reservoir (24 NLP).
- 24,000 AF New Los Padres Reservoir combined with 3 MGD desalination plant located in Sand City (24 NLP/D).
- 15,000 AF Cañada Reservoir combined with 3 MGD desalination plant located in Sand City (15 CAN/D).

- 7 MGD stand-alone desalination plant (7 DSL). This would be built in two stages, and entail a 3 MGD plant in Sand City and 4 MGD plant at the Monterey Regional Water Pollution Control Agency (MRWPCA) treatment plant near the City of Marina.

- No Project (NO PRJ), which reflects facilities and conditions anticipated in the year 1993.

The reservoir volumes refer to total storage; the usable storage would be less. Note that each of the above projects assumes additional pumping capacity in the Seaside Coastal Groundwater Subbasin, due to the Paralta Well, and a comprehensive conservation program, which includes wastewater reclamation for golf courses and open space in Del Monte Forest. These facilities and programs are included in all computer simulations and subsequent analyses in this SD EIR/EIS-II. Separate hydrogeologic studies have been performed to ascertain that the additional pumping capacity would be limited to quantities that would not adversely affect the Seaside Coastal Groundwater Subbasin.

A 15 percent reduction in per capita demand is the goal of the District's long-term conservation program. All computer simulations used in this document assume that the 15 percent goal is achieved. According to Cal-Am, the average residential water use in 1988, the pre-rationing base year, was 93 gallons per person per day. This amount would be reduced to 79 gallons per resident per day if the District conservation goal is achieved.

1.2 ENVIRONMENTAL REVIEW PROCESS

The California Environmental Quality Act (CEQA) requires that an Environmental Impact Report (EIR) be prepared that fully describes the environmental effects of a proposed project before a decision is made to proceed. The National Environmental Policy Act (NEPA) requires that an environmental impact statement (EIS) be prepared on major projects that involve federal funds or, in some cases, federal permitting authority. This document is a combined EIR and EIS and is written to fulfill the requirements of both CEQA and NEPA. It is a public document that will be used to examine the environmental effects of a proposed project and its alternatives, and to explore ways to lessen or avoid adverse environmental effects. The environmentally least damaging (CEQA), environmentally preferable feasible alternative (NEPA) and the District's overall preferred alternative are also identified in the EIR/EIS.

The District and the U.S. Army Corps of Engineers are lead agencies for the EIR/EIS. The lead agencies are responsible for preparing the environmental document and ensuring that it meets legal

requirements. The District is the lead agency for the EIR because it is the project proponent. The Corps of Engineers is the lead agency for the EIS because the District must obtain a permit from the Corps of Engineers pursuant to Section 404 of the Clean Water Act.

The first step in the CEQA process is the issuance of a Notice of Preparation informing interested parties that an agency intends to prepare an EIR on a project. The District issued a Notice of Preparation for a 29,000 acre-foot capacity New San Clemente Dam and Reservoir in June 1982. Meetings were held in 1982 and 1983 with government agencies and interested individuals to determine which issues should be addressed in the EIR. In 1986, before the CEQA process could be completed, the Corps of Engineers determined that an EIS was also needed. Accordingly, a Notice of Intent, the federal equivalent of the Notice of Preparation, was published in the Federal Register in August 1986. Two additional public scoping meetings were held in September 1986. The State of California identification number for this EIR/EIS is SCH 87092203; the U.S. Army Corps of Engineers 404 Permit application number is 16516S09.

A Draft EIR/EIS on the New San Clemente Project was released in September 1987. Due to concerns expressed by commenting agencies, the District Board determined in January 1988 that a Supplemental Draft EIR/EIS be prepared. The Supplemental Draft EIR/EIS was made available for public review in August 1991. Written comments on the document were received through October 1991.

As noted above, the District Board determined that a second Supplemental Draft EIR/EIS-II should be prepared to respond to concerns expressed in comments on the 1991 SD EIR/EIS and incorporate new information about project alternatives. This SD EIR/EIS-II is now available for public review. Written comments must be received by Monday, April 26, 1993. In addition, informal public workshops will be held on Wednesday, April 7 (3:30 and 7:30 PM) in Monterey, and Monday, April 12 (7:30 PM) in Carmel. Public hearings to receive oral comments on the document will be held on Thursday, April 22 (3:30 and 7:30 PM) in Monterey. Responses to comments will be prepared and included in the Final EIR/EIS. The Monterey Peninsula Water Management District will then review the Final EIR/EIS, and decide whether the EIR/EIS accurately portrays the environmental consequences of implementing the selected project, thus fulfilling CEQA requirements. A public hearing to certify the Final EIR/EIS will be held in late 1993. The Corps of Engineers will make similar determinations with respect to NEPA requirements.

This SD EIR/EIS-II summarizes and incorporates by reference the Near-Term Desalination Project EIR (SCH #91063064) prepared by the District. A Near-Term Desalination Project is being proposed by the District that would entail construction of a 3 MGD plant in Sand City by 1995, pending voter approval of the project; an authorizing election is scheduled for June 8, 1993. The Desalination Project EIR contains site-specific information on the environmental effects of a desalination plant at the preferred Sand City site as well as sites near the City of Marina and Moss Landing. The Final EIR for the Near-Term Desalination Project was received by the District Board in December 1992 and certified in January 1993.

1.3 ORGANIZATION OF THE EIR/EIS

The water supply system improvement alternatives being considered could affect a broad geographical area and many different aspects of the environment. A comprehensive evaluation of the alternatives is necessarily lengthy. The EIR/EIS has been organized to be useful to both the technical reviewer who needs to consider the impacts in detail and the more general reader who wants to understand the main consequences of implementing the alternatives, but does not have time to read the entire report. The Summary of the report can be found immediately prior to the Table of Contents.

Following this introduction, Chapter 2 describes the need for the project and previous actions by the District regarding water supply and restoration of the lower Carmel River. Chapter 3 describes the process whereby the five alternatives evaluated in this document were selected for analysis from a broad range of options. Chapter 4 describes the five project alternatives, which include the No Project alternative. Both CEQA and NEPA require that the environmental consequences of a No Project alternative be examined.

The direct effects of the alternatives on various aspects of the environment are described in Chapters 5 through 18. Each chapter is generally organized into three sections: (1) a description of the environmental setting, (2) an assessment of the environmental impacts of operation of each alternative, and (3) an assessment of the environmental impacts of construction of each alternative. Mitigation measures to avoid or reduce impacts to a less than significant level are also included. The environmental impacts of project operation would be long-term effects that would continue for the life of the project. The environmental impacts of project construction would be felt for a relatively short period of time.

Chapter 19 discusses the cumulative effects of growth on the Monterey Peninsula that would be allowed by the water supply alternatives considered. Chapter 20 identifies the "environmentally superior alternative," as required by CEQA, as well as the "environmentally preferable feasible alternative," as required by NEPA. In addition, Chapter 20 identifies the District's "overall preferred alternative," which is selected based on environmental impacts, achievement of project purposes, reliability and cost. Chapter 21 addresses several matters of environmental philosophy, as required by CEQA and NEPA. Agency and public involvement is described in Chapter 22. Contributors and preparers of the report are listed in Chapter 23, and a glossary of terms and acronyms is provided in Chapter 24.

The District and its consultants have conducted numerous technical studies in support of the environmental process. The studies are too extensive and detailed to be included in the EIR. Instead they are summarized in the text and appropriately referenced. A selected listing of these technical support documents can be found in Appendix 1. Other reports attached as appendices are described below, and are labeled according to chapter number. Some chapters do not have corresponding appendices.

Appendix 2-A documents how the water demand estimates at buildout, described in Chapter 2, and the minimal yield standard used in the 1988 alternatives evaluations were developed. Appendix 2-B describes how buildout estimates were revised, based on new information developed in 1992. Appendix 2-C is the mitigation plan adopted with the Final EIR for the Water Allocation Program in November 1990. Appendix 3 describes the initial process to select alternatives for analysis in this EIR/EIS (See Chapter 3). Appendix 5 is a summary description of the Carmel Valley Simulation Model (CVSIM), a computerized mathematical model which is used to simulate water supply performance (Chapter 5) and numerous hydrologic parameters (Chapter 7). Appendices 7-A, 7-B and 7-C provide hydrologic data on project impacts to Carmel River streamflow, as well as aquifer storage in Carmel Valley and Seaside. Appendix 8 is the steelhead spawning habitat mitigation plan, as described in Chapter 8.

Several technical reports support the analyses provided in Chapter 9, "Vegetation and Terrestrial Wildlife." Appendices 9-A and 9-B provide lists of plant and wildlife species, respectively. Appendix 9-C contains several studies of sensitive species that may be found in the project area. Appendix 9-D provides letters from State and federal agencies regarding Species of Concern. The Draft Mitigation

Plan for Valley Oak Woodland eliminated by the New Los Padres project is shown in Appendix 9-E; the Conceptual Restoration Plan for vegetation in the construction zone is provided in Appendix 9-F. The Habitat Assessment and Draft Mitigation Plan for riparian vegetation are shown in Appendices 9-G and 9-H, respectively. Appendices 9-I and 9-J provide documentation on project effects on the riparian corridor downstream of San Clemente Dam.

State and federal air quality standards as well as other emissions information are shown in Appendices 11-A through 11-L. Appendix 17 provides a Policy Consistency Analysis for each alternative. Appendix 19-A provides revised housing and employment estimates at buildout as of May 1992; Appendix 19-B summarizes possible mitigation measures for growth impacts. The Appendices are contained in a separately bound companion volume to the Supplemental Draft EIR/EIS-II.

Forty-two written comments and 14 oral comments on the 1991 SD EIR/EIS were received. Though this document is not a Final EIR/EIS, the District has provided individual written responses to each person, group and agency that commented on the 1991 document as a matter of comity. The long-term Water Supply Project Final EIR/EIS will entail responses to comments on this document.

2. NEED FOR A WATER SUPPLY PROJECT

2. NEED FOR A WATER SUPPLY PROJECT

2.1 EXISTING SITUATION AND NEEDS

The Monterey Peninsula Water Management District (MPWMD or "District") is responsible for regional water supply planning within a 170-square mile area consisting primarily of the Monterey Peninsula and the Carmel Valley (Figure 1-1). The Monterey Peninsula depends solely upon local resources to meet its water supply needs. About 95 percent of the customers within MPWMD's boundaries are supplied with water by the California-American Water Company (Cal-Am). Cal-Am obtains its water by diversion from San Clemente Reservoir and from wells in Carmel Valley and Seaside. The remaining users obtain their water from small water systems and private wells. About 82 percent of the total water produced within the District's boundaries in normal years is supplied by Cal-Am.

Improvements to the Monterey Peninsula's water supply system are needed for several reasons. First, though water supply in normal years far exceeds demand, the area is vulnerable to climatic variability and the impact of multiyear drought on limited local water supply resources. Since 1976, the community has suffered mandatory rationing for two extended periods: 18 months in 1976-78, and from January 1, 1989 until May 1, 1991 (28 months). Second, the demand for water is increasing within the District's boundaries as new homes and businesses are built. Tourism, a primary industry in the area, has increased due to construction of the nationally recognized Monterey Bay Aquarium in 1984 as well as increased visitor-serving facilities and attractions. Prior to 1988, per capita water consumption had risen because of changing land use and socioeconomic factors in the previous 10 years.[1] Without an increase in the water supply available to the District, the risk of water shortages in dry years will become greater as time passes. Third, as discussed in the MPWMD Water Allocation Program Final EIR, the present level of water demand adversely affects the environmental quality of the Carmel River because insufficient water supply is available for migratory fish and riparian vegetation.[2]

The MPWMD has already taken a number of actions that address these problems. Actions include implementation of a water conservation program to reduce future water demand, limitations to total system production, improved management of groundwater resources to increase the supply available to the District, and increased pumping capacity in the Seaside Coastal Groundwater Subbasin. In addition, several river management and emergency programs have been implemented to improve environmental conditions in the Carmel River. Although beneficial, these actions alone cannot supply sufficient water to meet future demand, improve drought protection nor provide adequate streamflow to protect the environmental quality of the Carmel River.

The District has proposed a new dam and reservoir on the Carmel River to solve the aforementioned problems. For the purposes of the federal Clean Water Act, Section 404 permit, a 24,000 AF New Los Padres Reservoir was identified as the proposed project in March 1989. The basic project purpose is to augment water supply to reduce drought vulnerability and provide for planned growth, as defined by the General Plans of cities and County areas within the District. The overall project purpose is to provide adequate instream flows to protect the public trust resources of the Carmel River at least 85 percent of water years.

Because of its mandate to preserve and protect the Carmel River environment, the District will also consider how project alternatives correct existing environmental degradation in the lower Carmel Valley in its selection of the overall preferred alternative. The reasons why the proposed project is needed and the actions already taken by the District are described in more detail in the following paragraphs.

2.2 DROUGHT VULNERABILITY

The ability of a water purveyor to reliably supply water to a community depends on maintaining an appropriate balance between demand and supply as well as the ability to treat and distribute water to customers. If demand increases but supply does not, water shortages in dry years will become more frequent and more severe. Water demand projections are described in Section 2.3, while water supply data for the various alternatives are presented in Chapter 5.

The Carmel Valley watershed experiences extreme variabilities in rainfall and subsequent streamflow. Annual streamflow records show that mean or median values rarely occur in any one year. In addition, there is a significant difference between median and mean streamflows in the river. For

example, at Robles del Rio the average streamflow mean of 72,963 AF/year is 35 percent higher than the median value of 53,961 AF/year. The reason for this large difference is that infrequent, but extremely wet events like water year 1983 occur between more numerous drier years.

Two dams exist on the Carmel River system -- San Clemente Dam and Los Padres Dam. The two dams were built in 1921 and 1949, respectively, and provide minimal usable water storage capability totalling about 2,580 AF at present. This surface storage is about 15 percent of estimated 1991 normal year demand (about 17,000 AF/year Cal-Am production). About 93 percent of the 20.6 inches of average rainfall at San Clemente Dam occurs in the six-month period between November 1 and April 30. In any series of dry years, the limited volume of surface storage is rapidly depleted by the second dry winter, and the community must rely on ground water extractions. Groundwater production from basins in Carmel Valley and Seaside are also limited by the total usable storage of the aquifers (about 33,900 AF), the number of wells, reductions in well pumping capacity as ground water levels drop, and environmental impacts.

Inspection of a 90-year reconstructed record for Carmel River streamflow at San Clemente Dam (water years 1902-1991) shows that seven periods of two or more consecutive dry or critically dry years (20 years total) have occurred. Two drought periods lasted three or more consecutive years. One period (1947-1950) exhibited four consecutive years of dry or critically dry streamflow. The recent 1987-1992 drought totaled six dry or critically dry years in a row. At present demand levels, rationing would be expected by the summer of the second year in most of these situations.

The Monterey Peninsula has endured extended mandatory rationing for two periods in the past 15 years. In the first year of the 1976-77 drought, without any mandatory water use restrictions, Cal-Am production was 16,000 acre-feet. In the second year of the drought, with mandatory water rationing (i.e., 50 gallons per day per person), Cal-Am production was limited to 8,500 acre-feet; this represented a 47 percent reduction.[3] To reduce the risk of another shortage, Cal-Am constructed four new wells in the lower Carmel Valley. The new wells tapped a previously unused portion of the Valley's underground water resources and thus increased the total supply available to the District. Cal-Am also constructed the Cañada de la Segunda pipeline which connected Seaside with Carmel Valley. In recent years, Cal-Am has expanded the capacity of its Begonia Iron Removal Plant in Carmel Valley. A new well in the Seaside Coastal Subbasin has been developed, but the water must

be treated due to water quality concerns. This well is scheduled to be in production by mid-to-late 1993.

The above improvements helped alleviate the impacts of the 1987-1992 drought, which entailed two dry and four critically dry years. The District responded to the drought with a 10 percent "voluntary rationing" program in summer of 1988, which was expanded to a 20 percent mandatary rationing on January 1, 1989. These water use restrictions resulted in a 30 percent decrease in Cal-Am water production from 1986-87 to 1989-90 and 1990-91, resulting in a nearly 6,000 AF reduction in demand. Mandatory 20 percent rationing was reduced to voluntary 10 percent levels on May 1, 1991, which continued until July 20, 1992. Though mandatory rationing has been lifted, prohibitions on water waste continue to be in effect.

2.3 WATER SUPPLY FOR PLANNED GROWTH

Since 1940, demand for water in the Monterey area has more than tripled, reflecting a nearly three-fold increase in population and economic growth. Unless growth is constrained by building moratoria or other measures, demand for water is expected to increase in the next 30 to 40 years as a result of planned growth within the MPWMD boundaries, though not at the same rate as in past decades. Tables 2-1 and 2-2 provide a District-wide summary of estimated future housing and employment, respectively, at buildout.[4] Assuming 1988 year water usage rates for homes and businesses, planned growth alone could result in an additional 6,740 acre-feet per year (AF/yr) of new demand at buildout. The water use rates used include 0.25 AF/yr for each urban single-family home; 0.17 AF/yr for each apartment unit; 0.15 AF/yr for each hotel room; and 0.12 AF/yr for each new employee, excluding hotels and golf courses. (See Appendices 2-A and 2-B for detailed information.) "Buildout" is defined as the planned growth that could legally exist within the MPWMD boundary under the General Plans, zoning and other applicable land use policies of the jurisdictions within the District as of May 1992.

Generally speaking, when development projects (especially major projects) have been approved by planning agencies on the Monterey Peninsula, the densities allowed have been less than the maximums described in General Plans and zoning ordinances. Thus, in practice, total housing and employment at buildout may be less than the legally allowable amounts shown in Tables 2-1 and 2-2. Since future decisions by planning agencies cannot be determined, the theoretical buildout water demand is used for planning purposes in this EIR/EIS.

TABLE 2-1

DISTRICT-WIDE SUMMARY OF HOUSING & POPULATION

	Existing			Additional Potential			Buildout Total		
	1988 Study (Jan 1, 1988)[1]	1992 Adjustment[2] Number	1992 Adjustment[2] Total	1988 Study	1992 Adjustment[2] Number	1992 Adjustment[2] Total	1988 Study	1992 Adjustment[2] Number	1992 Adjustment[2] Total
Residential Units									
Single-Family Units									
Carmel-by-the-Sea	2,593			379			2,972		
Del Rey Oaks	573			3			576		
City of Monterey[3]	6,381			(313)			6,068		
Pacific Grove	5,244			232			5,476		
Sand City	74			0	+20	20	74	+20	94
Seaside (Cal-Am)[4]	4,901			295			5,196		
Seaside (Non Cal-Am)[4]	620			0			620		
County of Monterey (Cal-Am)	8,190			2,717	-682	2,035	10,907	-682	10,225
County of Monterey (Non Cal-Am)	868			887			1,755		
Subtotal Single-Family	29,444			4,200	-662	3,538	33,644	-662	32,982
					-15.8%			-2.0%	
Multi-Family Units									
Carmel-by-the-Sea	619			506			1,125		
Del Rey Oaks	9			151			160		
City of Monterey[3]	6,721			5,089	-174	4,915	11,810	-174	11,636
Pacific Grove	2,769	+169	2,938	2,661			5,430	+169	5,599
Sand City	23			2,617	-709	1,908	2,640	-709	1,931
Seaside (Cal-Am)[4]	2,516			614			3,130		
Seaside (Non Cal-Am)[4]	150			0			150		
County of Monterey (Cal-Am)	1,955			279	+59	338	2,234	+59	2,293
County of Monterey (Non Cal-Am)	56			0			56		
Subtotal Multi-Family	14,818	+169	14,987	11,917	-824	11,093	26,735	-655	26,080
		+1.1%			-6.9%			-2.4%	
Total Dwelling Units	44,262	+169	44,431	16,117	-1,486	14,631	60,379	-1,317	59,062
		+0.4%			-9.2%			-2.2%	
Population									
Carmel-by-the-Sea	4,978			1,589			6,567		
Del Rey Oaks	1,520			402			1,923		
City of Monterey[5]	31,397			10,922	-384	10,538	42,319	-384	41,935
Pacific Grove	16,367	+345	16,712	5,909			22,276	+345	22,621
Sand City	200			5,395	-1,420	3,975	5,595	-1,420	4,175
Seaside (Cal-Am)	21,808			2,673			24,481		
Seaside (Non Cal-Am)[4]	2,264			0			2,264		
County of Monterey (Cal-Am)	24,094			7,116	-1,480	5,636	31,210	-1,480	29,730
County of Monterey (Non Cal-Am)	2,195			2,107			4,301		
Total Population at Buildout	104,823	+345	105,168	36,112	-3,284	32,828	140,937	-2,939	137,996
		+0.3%			-9.1%			-2.1%	

1 Population figures for January 1, 1988 differ slightly from those estimated by the California Department of Finance (DOF) because the dwelling unit counts used in this report differ slightly from those used by DOF.
2 See 1992 Update discussion in text and Appendix 19.
3 Excludes 2,520 existing and 396 future beds in military barracks.
4 Excludes military housing at Fort Ord.
5 Includes military population associated with 2,520 existing and 396 future beds in barracks.

Source:EIP Associates

TABLE 2-2

DISTRICT-WIDE SUMMARY OF EMPLOYMENT – 1992 ESTIMATE

Jurisdictions	Existing (Jan 1, 1988)	Additional Potential	Buildout Total
Carmel-by-the-Sea	3,555	1,409	4,964
Del Rey Oaks	498	266	764
City of Monterey (excluding Monterey Research Park)	27,175	12,173	39,348
Monterey Research Park	0	8,404	8,404
Pacific Grove	4,444	1,323	5,767
Sand City	1,550	4,000	5,550
Seaside (Cal-Am)	3,960	4,320	8,280
Seaside (Non Cal-Am)	170	30	200
County of Monterey (Cal-Am)	4,824	1,935	6,759
County of Monterey (Non Cal-Am)	101	471	572
Total Employment	46,277	34,331	80,608

Source: EIP Associates

Total water demand within the Cal-Am service area could increase from an estimated normal year use of about 17,000 AF in 1991 to a normal year demand of about 22,750 AF/yr at buildout, assuming successful implementation of the District's long-term 15 percent conservation program, plus demand from intensification, remodels and a District contingency reserve. Thus, a net increase of about 5,750 AF of new Cal-Am water use could occur at buildout.

Without a long-term water supply project, the severity, frequency and duration of future water shortages would increase as demand increases. At buildout demand levels of about 22,750 AF/yr Cal-Am production, rationing would occur in every critically dry period, even with the new Paralta well that is planned for the Seaside Coastal Groundwater Subbasin. The severity of shortfalls would also increase as demand increases. Because this level of drought vulnerability is unacceptable, the community is constrained from realizing planned growth until new, significant water supplies are developed.

2.4 ALLEVIATE DEGRADATION OF THE CARMEL RIVER

The Final EIR on the District's Water Allocation Program concluded that existing water use, given existing facilities, has significant detrimental environmental effects.[5] It further concluded that Cal-Am water production of 16,744 AF, about 1,700 AF less than estimated 1988 normal year demand (18,400 AF) was the least environmentally damaging production alternative. This corresponds to a limit of 19,881 AF for the Monterey Peninsula Water Resource System, which includes non-Cal-Am production. Even at this reduced level, significant environmental impacts to fish and riparian vegetation would occur due to lack of flow in the lower Carmel River. A comprehensive mitigation program has been approved by the Board, but potentially significant adverse impacts would remain. Wildlife experts agree that the key element to reduce environmental degradation is river flow.[6]

To understand how present water supply practices are harming the Carmel River, it is necessary to understand the hydrology of the Carmel Valley and how water supplies are presently obtained. The wells in the Carmel Valley pump water from a narrow, shallow and relatively small groundwater basin or aquifer that lies below the Carmel River and the valley floor.[7] The groundwater basin is recharged primarily by water that percolates into the ground from the Carmel River as it flows over it. Under natural conditions, groundwater levels in the aquifer would remain high year-round, although they would tend to drop somewhat in the dry season due to evapotranspiration by riparian vegetation and natural subsurface outflow. Modest amounts of river water would percolate into the

ground from the river to replace the water withdrawn by vegetation. Because water is removed from the aquifer by wells, groundwater levels now drop sharply during the dry season. River flows are depleted because much of the streamflow percolates into the ground to replace the water withdrawn by the wells. During droughts, river flow in the lower Carmel Valley may become discontinuous or dry for several years. For example, the Carmel River was dry below river mile 3.2 for almost four years between April 1987 and March 1991. During this period, no flow reached the Carmel River Lagoon or Carmel Bay. For this same period during the low-flow months (i.e., May - October), flow in the Carmel River was regulated and continuous only upstream of river mile 14.3.

Both the depleted streamflow and the lowered groundwater level have significant adverse environmental consequences. The Carmel River has supported the southernmost significant wild steelhead run in California.[8] Low fall and springtime river flow prevents juvenile fish from moving downstream to the lagoon and ocean. Fish become trapped in shrinking pools and die of temperature stress, oxygen depletion or predation. In dry winters with no continuous flow to the sea, adults are unable to enter the river to spawn. Based on surveys conducted in April 1991 and 1992, less than 20 adults were estimated to be in the river, and juvenile populations are significantly reduced. Experts believe that the present run has been reduced to an intermittent and unstable "remnant run" during the 1987-1992 drought years.[9] The District has conducted numerous "fish rescues" as part of its Interim Relief and Fisheries Mitigation Programs to help maintain the declining steelhead population.

The lowered groundwater level reduces the amount of water available to riparian vegetation, leading to stress and die-offs. The loss of riparian vegetation has contributed to bank erosion and destabilization of the river channel, which has endangered riverside properties and adversely affected scenic qualities. In addition, numerous fish, bird and wildlife species dependent on riparian habitat may be affected.

This situation resulted in complaints being filed before the State Water Resources Control Board (SWRCB) against Cal-Am Water Company. The complainants allege that Cal-Am is illegally diverting underflow of the Carmel River and that water supply practices result in unacceptable damage to the Carmel River environment. The SWRCB held hearings on the complaints in Fall 1992, and is expected to make a decision on this issue in Spring 1993.

A new dam and reservoir are seen as the most effective means to alleviate stress on the lower Carmel Valley aquifer and provide for the water supply needs of the community. Annual Carmel River flow in normal years is 3-4 times greater than annual municipal demand. Thus, excess winter flow could be stored in a reservoir for release and percolation into larger downstream aquifer subunits (where most production wells occur) during dry periods. This conjunctive use would improve overall system storage and provide flow throughout the lower Carmel Valley, thereby reducing habitat degradation.

2.5 ACTIONS ALREADY TAKEN

Recognizing the above problems, the District has already taken action to reduce demand and improve environmental conditions in the Carmel River, but these measures have limited effectiveness. The ordinances and programs now in place are described below.

2.5.1 WATER ALLOCATION PROGRAM

In order that the eight political jurisdictions (six cities, the Airport District, and parts of Monterey County) within the District can maintain their water demand within the limits of available supply, the District has implemented a program for the allocation of new water as it becomes available. The allocation system is a key element in the process by which water demand and water supply are kept in balance. If a jurisdiction's water usage exceeds its allocated amount, the District would cease granting new water connection permits in that jurisdiction.

Until November 1990, the District allocated 20,000 AF/yr of Cal-Am production, based on normal year demand. The Final Allocation Program EIR, certified on November 5, 1990 found that this level of production had significant adverse effects on the environment. On December 13, 1990, the District Board finalized an ordinance that formally sets the new normal year allocation for the Cal-Am system at 16,744 AF annual production and at 19,881 AF annual production for the Monterey Peninsula Water Resource System as a whole (including 3,137 AF for non Cal-Am production). Because estimated normal year demand for the Cal-Am system is nearly 17,000 AF, the Board also passed a moratorium on all new connections, which has been in effect since January 1, 1991. The moratorium and production limit can be amended at the time that new water supplies are developed.

The Board also adopted a five-year comprehensive mitigation plan because even the reduced allocation limit of 16,744 AF of annual Cal-Am production entails significant adverse impacts to the

environment. The mitigation plan, which is attached as Appendix 2-C, entails programs for fish, riparian vegetation and associated wildlife, lagoon vegetation and associated wildlife, and aesthetics. These programs incorporate and supersede many aspects of the Interim Relief Program described in Section 2.5.4.

2.5.2 WATER CONSERVATION PROGRAM

Limited water supplies and the community's vulnerability to droughts spurred water conservation efforts since the mid-1980s. Conservation is a means to stretch existing water supplies, reduce stress to the environment, and increase community protection from drought. The Monterey Peninsula has relatively low residential water use rates. For example, Cal-Am Water Company data indicate that the average annual residential consumption in 1988 was about 93 gallons per person per day (gppd) compared to a state average of about 150 gppd. After two years of mandatory rationing, the 1990 and 1991 average use was only 59 gppd.

Even with the already low water use rates, in 1987, the MPWMD adopted a water conservation goal of nine percent by the year 1990, which corresponded to a decrease in Cal-Am demand of about 1,600 AF. Estimates in November 1990 indicate that this goal has been achieved. In addition, the District has a long-range goal of a 15 percent reduction of projected use by the year 2020 (that is, 15 percent less demand than buildout levels if conservation were not practiced). To achieve these goals, a Water Conservation Plan has been adopted, and measures outlined in the plan are being implemented.[10] The following paragraphs briefly outline the principal measures of the District's conservation program, which has averaged about $100,000 per year. It should be noted that the District works cooperatively with Cal-Am on several elements of the conservation program.

Water Conservation Ordinance

The cornerstone of the District's water conservation program is a water conservation ordinance. This ordinance is expected to reduce water consumption for new development by 20-30 percent compared to 1980s per capita demand, and result in water savings of over 10 percent per house for existing development. Based on provisions in the ordinance, this savings would be gained by retrofitting plumbing fixtures at the time a property is sold. These savings are expected to be significant, as some 200-300 residential units are sold each month within the District boundaries. Further savings will be

realized from commercial properties as they transfer ownership or change use. The requirements of the ordinance are outlined below:

- New Construction

  1.6 gallon/flush toilets
  2.5 gallon/minute showerheads
  2.5 gallon/minute faucet aerators

- Existing Buildings

  At time of sale, replace toilets with 1.6 gallon/flush maximum; replace showerheads with 2.5 gallon/minute type; install faucet aerators which limit flow to 2.5 gallons/minute.

  If floor area is increased by 25 percent over existing surface area, the above requirements are imposed.

  For commercial uses, when there is a change in business use, the above requirements are imposed.

  All commercial land uses must install a toilet flow reduction device and change showerheads to types using no more than 2.5 gallons/minute by December 13, 1987.

Water Conservation Kit Program

The District implemented a successful voluntary water conservation kit distribution program in Spring 1988. Kits were provided to nearly all residences in the District (about 44,000 homes and apartments). Kits included toilet dams, low-flow shower heads and faucet aerators. Follow-up studies in December 1988 showed that about 93 percent of residences installed the kits, resulting in estimated annual water savings of about 800-1,000 AF per year.

Turf Management Program

Golf courses, school campuses, military parade grounds and other turf areas consume significant amounts of water. Golf course water use alone accounts for about 1,300 AF of water annually in the Cal-Am system, and about 2,600 AF, overall. The MPWMD has sponsored seminars on turf management to help reduce water use.

Leak Detection

The District holds periodic seminars on leak detection to assist water purveyors in improving efficiencies. Cal-Am has an unaccounted water factor of about 7 percent, which compares well to

the industry average of 15 percent. This factor includes fire flows, line flushing and sewer cleaning as well as loss due to leakage. Other, smaller mutual water companies have much greater water losses, as much as 30 percent. Cal-Am has a leak detection program that uses computerized detection equipment for both internal and customer use.

Public Awareness

The District and Cal-Am have an ongoing public awareness campaign to promote water conservation. This program includes print and radio advertisements, brochures, public service announcements and speakers on conservation.

Public Policy

Each city and county area determines how the water saved in its jurisdiction is used. Each community has determined that the savings should be applied to new development with a reserve, in some cases, set aside for drought protection. The District's policy is to limit the reinvestment of conservation savings into new development to 50 percent of the total savings.

2.5.3 WASTEWATER RECLAMATION

The CAWD/PBCSD Wastewater Reclamation Project will provide approximately 800 acre-feet of treated wastewater to irrigate golf courses and open space areas in Pebble Beach, which will replace potable water now used for irrigation. The project involves the construction of a new tertiary treatment plant to be located adjacent to the existing Carmel Area Wastewater District's (CAWD) secondary wastewater treatment plant. It also entails construction of a new wastewater distribution system, 2.5 million gallon storage tank, and irrigation system improvements that will be used to distribute the wastewater to the receptor sites in Pebble Beach. The tertiary treatment plant will produce water which meets Title 22 standards specified by the California Department of Health Services, which is a quality acceptable for human contact.

This project is a cooperative effort between the Carmel Area Wastewater District, the Pebble Beach Community Services District (PBCSD), the Monterey Peninsula Water Management District (MPWMD), and the Pebble Beach Company. The tertiary treatment plant and a portion of the distribution system will be owned and operated by CAWD. The distribution system and storage tank located in Pebble Beach will be owned and maintained by PBCSD. MPWMD has provided the

funding for the project through the issuance of $33.9 million in Certificates of Participation in December 1992. The Pebble Beach Company, as fiscal sponsor of the project, has guaranteed the bond repayment and payment of annual operating expenses not covered by the reclaimed water sales revenues. In return, the fiscal sponsor will receive a water entitlement of 380 acre-feet which will be dedicated to specific lots in Pebble Beach for future development. The remaining 420 acre-feet of potable water freed by the project will be available to the District for drought reserve or new development.

Construction of the CAWD/PBCSD Wastewater Reclamation Project began in January 1993, and is expected to be completed within 18 months (mid-1994).

2.5.4 INTERIM RELIEF PROGRAM

As noted in Section 2.4, inadequate storage and community reliance on groundwater pumping has detrimental effects on the Carmel River environment. This situation resulted in a complaint to the State Water Resources Control Board against Cal-Am and Water West (acquired by Cal-Am in 1989) by the Carmel River Steelhead Association (CRSA). In 1988 the District formed the Environmental Advisory Committee (EAC), comprised of citizens group and public agency representatives. The EAC developed an Emergency Relief Program and an Interim Relief Program to address chronic environmental degradation. The Interim Relief Program functions as an interim settlement of the CRSA complaint, and will continue until the District constructs a water supply project that meets water demand and environmental enhancement requirements.

The Interim Relief Program focuses on rescuing stranded steelhead, preserving the riparian corridor and enhancing aquatic habitat via more instream flow. Since 1988, the District has (1) hired two professional fishery biologists to assess habitat and coordinate fish rescues, (2) provided staff and new equipment for numerous fish rescues, (3) monitored the status of riparian corridor using several techniques, and (4) installed approximately 450,000 lineal feet of drip irrigation line to preserve trees in the riparian corridor. These activities are now incorporated into the Water Allocation Program Mitigation Plan described in Appendix 2-C.

Another important action was to revise the District's Water Supply Strategy ordinance to reduce diversions from San Clemente Dam from 35 percent of total annual Cal-Am production to 29 percent, and reduce diversions from April through November. These changes allow greater releases

from San Clemente Dam to benefit valuable habitat downstream of the dam. Also, the District Board changed the review period for the Water Supply Strategy from an annual to a quarterly basis.

2.5.5 REDUCE SURFACE DIVERSIONS FROM CARMEL RIVER

Cal-Am can withdraw water from the Carmel Valley by direct diversion from the existing San Clemente Dam or by pumping wells lower down the valley. Water taken directly from the dam is treated at the filter plant before distribution to customers. Prior to 1985, Cal-Am could produce as much water as possible from the reservoir, with the balance taken from the wells. On an average, this operating practice resulted in Cal-Am obtaining 55 percent of its total water production directly from the dam.

In December 1984, the District passed Ordinance No. 19 requiring that Cal-Am divert no more than 35 percent of annual production directly from the dam and allow more water to flow down the river. As noted above, the Interim Relief Program resulted in a further decrease in diversions from San Clemente Dam (29 percent of total production) since 1988. To replace the water not diverted at the dam, Cal-Am has increased pumping from wells lower down the valley. Most of the increased well production has occurred from wells below Scarlett Narrows at River Mile 9, where production has averaged 48 percent of total Cal-Am system production since 1986. The water released down the river benefits the fishery and riparian vegetation before being extracted for water supply without a significant loss of water for the latter purpose. Thus, the water is essentially "multiple use" water, or "conjunctively" used.

The District, Cal-Am and the California Department of Fish and Game (CDFG) annually cosign a Memorandum of Agreement regarding operating procedures. These parties meet quarterly to develop strategies that will provide for municipal needs with as little environmental damage as possible. The District Board quarterly reviews and approves the Water Supply Strategy and Budget for the Cal-Am system.

2.5.6 CARMEL RIVER MANAGEMENT PROGRAM

The District began implementation of the Carmel River Management Program in July 1983. The goal of the program is to restore the Carmel River to its former state as much as possible. The ten-year program consists of numerous individual bank stabilization and river projects designed to prevent

erosion and encroachment of riverside property, improve river bottom conditions for aquatic life and reestablish the corridor of riparian vegetation. Over 75,000 lineal feet of willows have been planted and maintained throughout the middle and lower river reaches since 1984.

2.5.7 IRRIGATION PROGRAM

The County of Monterey required Cal-Am to irrigate riparian vegetation near four production wells in lower Carmel Valley as part of its use permit. The District agreed to carry out the irrigation program. District and Cal-Am consultants determined the relationship between well pumping, ground water drawdown and elevated plant stress; various irrigation techniques were also analyzed.

A portable irrigation system was developed and deployed by the District whenever selected environmental parameters indicated plant stress. In 1989, the portable unit was replaced by a more efficient drip irrigation system. A regular monitoring program also assesses the irrigation system's performance. Results to date indicate that irrigation alleviates stress to vegetation in key reaches of the riparian corridor.

2.5.8 GROUNDWATER QUALITY MONITORING PROGRAM

In 1981, the District Board initiated a water quality monitoring program for groundwater from the Carmel Valley Alluvial Aquifer. This program was designed primarily to track water quality trends in the shallow portion of the aquifer (i.e., generally the upper 30 feet of saturated alluvium), and to serve as an early warning of potential water quality degradation due to septic systems or other sources. Elements of the program have been revised and expanded in recent years. For example, monitor wells in the coastal portions of the Carmel Valley Aquifer and the Seaside Basin have been added to monitor for seawater intrusion potential. Through this program, the District is able to collect important information regarding seasonal and long-term water quality fluctuations for use in preventing degradation of resources.

2.5.9 WATER RESOURCE INVESTIGATIONS

MPWMD staff and consultants have conducted a number of investigations to define and evaluate water resources within the District in order to improve surface and groundwater management. Refined estimates of groundwater storage capacity were determined and relationships between pumping capacity and groundwater storage were developed. Monitoring wells were drilled that

explored the water supply potential of undeveloped areas with the Seaside Inland groundwater subbasin. Several studies have also been conducted on the hydrogeology of the Seaside Coastal groundwater basin and lower Carmel Valley to assess proposed management methods, production potential and long-term yield. Consent from the California Public Utilities Commission was also obtained to increase the long-term yield from the Seaside basin.

The District has developed and coded an extensive computer model (CVSIM) of the Carmel Valley and Seaside Coastal subbasin water resources. The model aids in assessing various water supply alternatives and management scenarios. The District prepared and is implementing aspects of the Carmel River Watershed Management Plan.[11]

2.5.10 NEAR-TERM WATER SUPPLY PROGRAM

In 1989, in response to continued drought and the lengthy 404 permit process for a new dam, the District began its Near-Term Water Supply Program. "Near-Term projects" are those that can be brought on line in a relatively short period of time with relatively moderate expense. Examples of interim projects include new wells, subpotable water development, toilet retrofit programs, desalination and others. In addition to the reclamation efforts described in Section 2.5.3, the District has focused on two interim projects -- new wells in the Seaside Coastal groundwater subbasin and a 3 MGD seawater desalination facility. Based on hydrogeologic studies of the Seaside and Monterey coastal areas, wells have been explored in Seaside and Del Rey Oaks. A new Cal-Am municipal well in Seaside is expected to be in production by mid-1993.

In February 1991, the District initiated a feasibility study of several desalination alternatives. Based on the study results and other information, three sites were selected for further analysis in a Near-Term Desalination Project EIR. Alternative site locations for a 3 MGD desalination project included: a warehouse in Sand City, a facility at the MRWPCA Regional Treatment Plant near the City of Marina, and a facility at the PG&E power plant at Moss Landing. Based on the Draft EIR and the preliminary design report, the District Board selected the Sand City site as the preferred alternative. The Final EIR for the proposed project was certified in January 1993. Construction of the desalination facility will depend on an authorizing election for the project, scheduled for June 1993. If approved, the desalination project will be pursued by the District as a separate Near-Term Project, but could function as a phased component of a long-term water supply project.

The near-term projects, if successfully developed, will help reduce drought vulnerability for the existing Monterey Peninsula population. They do not adequately address the long-term needs of the community nor the environmental degradation of the Carmel River. Thus, a major, long-term water supply project is needed to provide for the future and address the problems summarized in the previous sections.

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1. Per capita water use in an area is obtained by dividing total water use by the area's population. It can be a misleading statistic because it is often assumed to approximate per capita residential water use. Within the District, daily residential per capita use in 1987-88 (prior to rationing) was quite low -- about 60 to 100 gallons per person for apartment dwellers and single-family homes, respectively. Even with low residential use, the overall daily per capita use rate would increase if water-consuming commercial development is added at a faster rate than that for new residents.

2. Riparian vegetation is the plant community that grows along rivers and streams. Only a small fraction of California's riparian vegetation remains unaltered. What remains is of great interest and concern to wildlife agencies.

3. Cal-Am's ability to produce water was constrained by the rationing program in effect; it is now believed that more water could have been provided.

4. Population and employment projections are described in detail in: EIP Associates, Estimates of Housing and Employment at Buildout within the Monterey Peninsula Water Management District--Final Report, Prepared for MPWMD, July 1988. Table 2-1 in SDEIR/EIS-II has been revised to incorporate a May 1992 update on buildout estimates. A detailed explanation of water demand corresponding to these growth projections is found in Appendices 2-A and 2-B.

5. Mintier and Associates, Final EIR -- Water Allocation Program. Prepared for MPWMD, April 1990.

6. Letter from Brian Hunter, Region 3 Manager of California Department of Fish and Game, November 2, 1990. Letter from Thomas L. Taylor, Senior Aquatic Biologist, California Department of Parks and Recreation, August 15, 1990. Testimony provided during SWRCB hearings on the Carmel River Basin, August 24-September 1, 1992.

7. This report is not intended to create the inference that groundwater in either the Carmel Valley or the Seaside/Ft. Ord area is or is not subject to the doctrine of prior appropriation, or is subject to the permit jurisdiction of the State Water Resources Control Board.

8. W.M. Snider, Reconnaissance of the Steelhead Resource of the Carmel River Drainage, Monterey County. CDFG Administrative Report 83-3. 1983

9. D. W. Kelley and Associates, Assessment of Carmel River Steelhead Resource; Volume II, Draft, June 1987. Dave Dettman, personal communication, April 1991. Testimony provided during SWRCB hearings on Carmel River Basin, August 24-September 1, 1992.

10. Monterey Peninsula Water Management District, et al, Water Conservation Plan for Monterey County, Final Draft, April 1984; revised 1989. The plan includes the measures listed in the text together with the substitution of reclaimed water for potable water for golf course and landscape irrigation.

11. MPWMD, Draft Carmel River Watershed Management Plan, April 1988.

3. SELECTION OF ALTERNATIVES FOR ANALYSIS

3. SELECTION OF ALTERNATIVES FOR ANALYSIS

3.1 INTRODUCTION AND PURPOSE

Section 404 of the federal Clean Water Act requires that all practicable alternatives that could achieve the project purposes be investigated. "Practicable" is defined as "available and capable of being done after taking into consideration cost, existing technology and logistics in light of overall project purposes."[1] The federal intent is for the project proponent to "consider those alternatives that are reasonable in terms of the overall scope/cost of the proposed project."[2] California state law also requires that potential environmental effects be assessed for reasonable alternatives to the proposed project, even if, to some degree, they do not achieve the project goals or may be more costly than desired.[3]

The purpose of the District's selection process was to identify a reasonable range of water supply alternatives for analysis in this EIR/EIS in compliance with the federal and state regulations. Given the large number of possible projects, a multi-phase selection process was used that spanned several years. This process is summarized below and the initial screening is described in detail in Appendix 3.

To facilitate effective communication and early resolution of regulatory agency concerns, an Interagency Group was convened by Representative Leon Panetta in 1988 to participate in the alternatives selection process. The group included representatives from the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Forest Service, California Department of Fish and Game, State Water Resources Control Board, and the State Department of Water Resources. The group reviewed and generally concurred with the final report for each phase before the District initiated a subsequent phase. In addition, public workshops were held for each phase of the selection process.

During most of the analysis, the District had two stated project purposes in the 404 Permit application: (1) provide drought reserve for existing residents and water supply for planned growth,

and (2) provide year round Carmel River flow at the USGS "near Carmel" gage, at least in normal and wetter years. On August 8, 1990, the Board amended the basic project purpose to include only one element -- water supply to provide adequate drought reserve and meet the needs of planned growth. This change did not alter the final results of the evaluation processes; actually, it broadened the possibilities. The revision responded to indications made by the U.S. Environmental Protection Agency at that time that it would evaluate the project based solely on a water supply purpose; the change also allowed direct comparison with the Cañada Reservoir alternative. It should be noted that revised basic project purpose was made only to facilitate the 404 Permit process; the District's mandate to preserve and protect the Carmel River environmental resources, reflected in the overall project purpose to improve streamflow conditions, has not changed. Provision of adequate instream flows to protect the Carmel River public trust resources remains an important component in the District's selection of the preferred project.

The following sections summarize the alternatives selection process that has occurred since 1988. This chapter provides an historical review of the initial evaluation of alternatives, followed by changes that were made by the District, based on new technical information and the impacts of the 1987-1992 drought. It should be noted that the Part I and Part II Evaluations described below reflected Board policies that existed at the time, and some elements are not relevant to today's situation.

3.2 PART I EVALUATION (1988)

The Part I evaluation was conducted in 1988 and completed in September of that year.[4] Subsequent research in 1989 clarified the status of questionable alternatives. The Part I evaluation considered all of the water supply alternatives described in Appendix 3 and summarized in Table 3-1.

A broad range of alternatives that could produce more water was explored, including (1) new dams on the Carmel River or its tributaries, (2) offstream storage reservoirs, (3) infiltration basins for recharge, (4) additional ground water development, (5) sediment removal from existing reservoirs, (6) importation of water, and (7) seawater desalination. In addition, the District considered alternatives that would more efficiently use existing resources, such as (8) wastewater reclamation and (9) additional components to the District's existing conservation program. State and federal laws require analysis of the No Project alternative.

TABLE 3-1

RATINGS FOR ALTERNATIVES CONSIDERED IN PART I SCREENING

Alternative	Pass	Cond. Pass[1]	Fail
I. Carmel River Mainstem Dams			
A. New San Clemente – RCC	X		
B. New San Clemente – Rockfill			X
C. New San Clemente – Joint Use			X
D. U.S. Army Corps of Engineers Proposals			
1. San Clemente Site			X
2. Cachagua Site			X
3. Pine Creek Site			X
4. Klondike Site			X
5. Los Padres			X
E. Enlarged Los Padres	X		
II. Carmel River Tributary Dams			
A. San Clemente Creek Variations	X		
B. Cachagua Creek Variations		X	
C. Chupines Creek Variations		X	
D. Buckeye Creek Variations			X
III. Sediment Removal			
A. Los Padres Reservoir	X		
B. San Clemente Reservoir	X		
IV. Storage and Infiltration Basins/Recharge			
A. Fort Ord Depressions			X
B. Seaside Groundwater Recharge – Coastal Barrier			X
C. Seaside Coastal Groundwater Subbasin – Recharge with Wells			X
V. Groundwater Development			
A. Seaside Coastal Groundwater Subbasin Well Development	X		
B. Seaside Inland Groundwater Subbasin Well Development			X
C. Upper Carmel Valley Well Development	X		
D. Lower Carmel Valley Well Development	X		
VI. Importation of Water from Distant Sources			
A. Arroyo Seco River			X
B. Lower Salinas Basin			X
C. San Felipe Project			X
D. Big and Little Sur Rivers			X

Alternative	Pass	Cond. Pass [1]	Fail
VII. Desalination		X	
VIII. Wastewater Reclamation			
A. Used for Groundwater Recharge			X
B. Use of Monterey Treatment Facility		X	
C. Irrigation of Del Monte Forest Golf Courses	X		
IX. Conservation			
A. Residential and Institutional Cisterns			X
B. Comprehensive Program including Mandatory Retrofit	X		

[1] Conditionally Passes – Additional information may result in subsequent determination that this alternative fails to satisfy Part I screening criteria.

Source: MPWMD

The purpose of the Part I analysis was to determine feasible alternatives on a qualitative basis, (except for cost) and identify those with serious cost, technological, logistical, availability or environmental constraints. Five criteria were used to assess alternatives in the Part I evaluation:

- Total annual cost limit of $8.64 million (includes capital cost, interest and other bond charges, and annual O&M). This limit reflected the District Board's desire to impose no more than a 30 percent increase to the average Cal-Am residential water bill in 1988.
- Reliable technology.
- Logistical constraints.
- Availability.
- Environmental effects.

Fourteen alternatives were identified as satisfying the Part I criteria. They included two mainstem dams, three tributary dams, dredging existing reservoirs, ground water development in Carmel Valley and Seaside, desalination, mandatory conservation and reclamation. The 25,000 AF Cañada Reservoir alternative was not proposed until February 1989, and thus was not analyzed in the Part I or Part II evaluations.

Alternatives That Did Not Satisfy Part I Criteria

The alternatives listed in Table 3-2 did not satisfy the Part I evaluation criteria and will not be addressed in subsequent chapters of this EIR/EIS. The reasons for this determination are briefly summarized in Table 3-2; more detailed information is available in Appendix 3.

3.3 PART II EVALUATION (1988)

The Part II evaluation, completed in November 1988, focused on alternatives that passed the Part I assessment (see Table 3-1).[5] It determined which alternatives (or combinations of alternatives) met four qualitative performance criteria and fell below the $8.64 million total annual cost limit. (As noted previously, the cost limit reflected a policy to impose no more than a 30 percent increase on the average Cal-Am residential water bill, or about $5.80 per month in 1988. This limit is no longer in effect.) The District's CVSIM computer model was used to simulate performance under future conditions (i.e., water demand at buildout) if the weather patterns that occurred between water years 1902 and 1987 were repeated.

TABLE 3-2

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

ALTERNATIVE	DESCRIPTION	REASONS FOR ELIMINATION
New San Clemente Dam (Rockfill)	Rockfill construction method used as "fallback" if RCC fails.	Fallback not needed; also more expensive and time-consuming.
45,000 AF New San Clemente Reservoir	Joint use reservoir for District, Fort Ord and Marina.	Rejected by Marina and Fort Ord due to cost; infeasible without their participation.
154,000 AF New San Clemente Reservoir	Flood control, recreation and water supply dam proposed by Army Corps.	Abandoned by Corps due to lack of community support. Flood control and recreation not District project purposes.
Upper Syndicate Dam (Cachagua)	Analyzed by Army Corps in 1970s.	Rejected in favor of New San Clemente Dam by Corps in 1981. Resource agency staff recommended against it due to loss of highly valued riparian habitat.
Lower Syndicate Dam (Pine Creek)	Analyzed by Army Corps in 1970s.	Rejected in favor of New San Clemente Dam by Corps in 1981. Would inundate homes and roads. Resource agency staff recommended against it due to loss of highly valued riparian habitat.
Klondike Dam	Analyzed by Army Corps in 1970s.	Rejected by Corps due to two active faults in reservoir area. Also would inundate expensive homes, roads and water treatment facilities.
New Dam at Existing Los Padres Site	Analyzed by Corps in 1970s.	Rejected by Corps because a dam larger than 4,000 AF would flood Ventana Wilderness; 4,000 AF would be inadequate to meet municipal supply.
Buckeye Creek Dam	2,000 AF offstream storage reservoir on Buckeye Creek; could divert water from San Clemente Dam or the Narrows.	Rejected due to technical problems; fault near toe of dam; left abutment formed entirely of landslide material; unsuitable foundation material; water quality concerns.
Fort Ord Depressions	Natural depressions and shallows valleys on Fort Ord Military Res. (lined or unlined) could be used as small reservoirs or infiltration basins.	Rejected due to lack of availability since most sites are in military firing ranges; water quality and safety concerns from spent (or unspent) ammunition. High cost to line depressions; questionable feasibility to recover infiltrated water.
Seaside Coastal Recharge--Coastal Barrier	Reclaimed water or fresh water diverted from Carmel Valley injected into coastal basin could prevent sea-water intrusion and allow greater pumping inland.	Rejected for technical reasons; tests conducted in 1981 indicated barrier recharge would not be successful.
Seaside Coastal Subbasin -- Recharge with Wells	Recharge and recovery of water through existing and new wells. Water would be diverted from Carmel Valley.	Rejected due to tech[illegible]l infeasibility. Two sets of tests showed that recharge would not be successful at anticipated quantities.

Table 3-2 (Continued)

ALTERNATIVE	DESCRIPTION	REASONS FOR ELIMINATION
Seaside Inland Subbasin -- Well Development	Groundwater development in the Seaside Inland Subbasin for use in the District. Most of the subbasin underlies Fort Ord Military Reservation.	Rejected due to questionable supply, lack of available well fields due to firing ranges on Fort Ord and preemptive water rights. An exploratory program concluded groundwater production potential was poor.
Upper Carmel Valley -- Well Development	Construction of new or enlarged Cal-Am wells in upper Carmel Valley aquifer.	Board adopted a policy not to pursue additional well development in this environmentally sensitive area.
Lower Carmel Valley -- Well Development	Construction of new or enlarged Cal-Am wells in lower Carmel Valley aquifer.	Board adopted a policy not to pursue additional well development, as fisheries and riparian habitat has been degraded due to existing practices. (Note: additional treatment/pumping capacity could be required by State Department of Health Services to meet maximum day (peak demand) as community demand approached buildout levels.)
Importation -- Arroyo Seco	Build large dam in southern Monterey County; provide water via a 56-mile canal to the Peninsula.	County Board of Supervisors abandoned project in 1983. A 1990 County study also recommended that it not be pursued.
Importation -- Lower Salinas Basin	Build a small diversion dam near Salinas, transmit water to small regulating reservoirs, and drill a dispersed well-field near Salinas.	Monterey Peninsula is not eligible for this water due to funding zone and lack of riparian rights; project not designed with the Peninsula in mind.
Importation -- San Felipe Project	Purchase water from Pajaro Valley area; source would be San Luis Reservoir	Rejected due to lack of available water due to other agencies' prior water rights, high costs for 30-mile pipeline and the need to build a storage reservoir since only offpeak supply would be considered.
Importation -- Big and Little Sur Rivers	Construction of dams on these rivers, as well as pipelines to transmit water.	Rejected because both rivers are protected by the State; both rivers are also being considered for federal protection.
Reclamation for Groundwater Recharge	Inject treated wastewater into Seaside Coastal subbasin to increase extraction potential from this area.	Rejected due to long-term health concerns and reluctance of State and County Health Departments to issue permits for projects of this type.
Reclamation for Turf Irrigation near Old Monterey Plant	Apply treated wastewater to irrigate turf at the Naval Post-graduate School and at the Old Del Monte Golf Course. (Note: Reclamation in Pebble Beach is part of all projects analyzed in this EIR/EIS)	Rejected due to tenuous nature of facilities and economic feasibility. Treatment plant was scheduled for demolition; suit settlement with nearby homeowners entails treatment plant shutdown once regional system is operational. Cost prohibitive unless Navy participates; they have drilled their own subpotable wells.
Cisterns -- Residential and Institutional	Construction of cisterns for all residences and large commercial or institutional buildings.	Not practicable as a District-wide program due to high cost per acre-foot and marginal benefits. District does support and provide information on cisterns to interested members of the public (voluntary).

The four Part II performance criteria reflect the District's two project purposes at the time (water supply and year-round streamflow) as follows:

- Firm yield in simulated water year 1977 must be at least 21,300 AF, assuming buildout demand. (These simulations included demand management and rationing, and are not comparable to the analysis in Chapter 5.)
- Maximum shortfall of 40 percent in any month.
- Maximum acceptable months of rationing in the 86-year simulated period is 52 months, or 5 percent of the time.
- Measurable simulated Carmel River flow must occur during the entire year at the USGS "near Carmel" gage in normal or wetter years.

A wide variety of alternative sizes and combinations of alternatives were evaluated with the above criteria and the total annual cost limit of $8.64 million per year set in the Part I evaluation. In some cases, several sizes or variations of an alternative passed the Part II criteria. In those cases, the variation with the lowest annual or incremental yield cost was selected for further analysis in the EIR/EIS.

PART II RECOMMENDATIONS

The Part II report recommended that six projects pass or conditionally pass the alternatives selection process. The conditional projects were those with technical or cost uncertainties that were not resolved when the Part II report was prepared. The six alternatives identified as passing the Part II evaluation are shown below. Note that those projects with asterisks (**) were considered "conditional" and were the subject of further study.

- 29,000 AF New San Clemente Dam
- 23,000 AF New San Clemente Dam

** 17,000 AF New San Clemente Dam plus new wells in lower Carmel Valley (aquifer subunit 4)

** 22,000 AF Enlarged Los Padres Dam

** 18,000 AF Enlarged Los Padres Dam plus new wells in lower Carmel Valley (aquifer subunit 4)

** 12,500 AF San Clemente Creek Dam (downstream site with pumped storage) plus new wells in lower Carmel Valley (aquifer subunit 4)

The Part II report also identified other alternatives that did not pass the Part II screening criteria. These were recommended to be discussed in the Supplemental Draft EIR/EIS to comply with the CEQA requirement to analyze a range of alternatives even if project goals are not met. They included a 10,500 AF Chupines Creek Dam, a 6,000 AF Cachagua Creek Dam, dredging existing reservoirs to original capacity, a 9,000 AF New Los Padres Dam and desalination.

Subsequent to the Part II evaluation, new technical and cost data resulted in amended descriptions for each of the above alternatives, as described in the following section.

3.4 SUBSEQUENT ACTION AND EVALUATIONS FOR SD EIR/EIS (1989-1991)

Since the Part II evaluation was completed in November 1988, several technical investigations were performed and significant action was taken by the District Board. A brief synopsis is provided below.

Revised Cost Estimates and Cost Limit

In June 1989, Bechtel Civil developed revised construction cost estimates for several project sizes at three dam sites -- New San Clemente, New Los Padres and San Clemente Creek.[6] The District's maximum total annual cost limit was also updated to a limit of $9.0 million per year, which reflected 1989 dollars, Cal-Am rate increases and changes in rate structures allowed by the California Public Utilities Commission in 1989.

Evaluation of Lower Carmel Valley Aquifer Subunit 4

Due to concern about the potential impacts of additional well capacity in the lower Carmel Valley, particularly the threat of seawater intrusion, two studies were performed in 1989. The consulting firm of Staal, Gardner & Dunne (SGD) performed extensive drilling and surface geophysical studies west of Highway 1.[7] In addition, Dr. Joseph Clark, geologist, summarized his surface geologic mapping along the Cypress Point fault, which traverses the mouth of the Carmel Valley.[8]

Based on the results of modeling an additional 1,000 AF of ground water extractions in the lower Carmel Valley, SGD concluded that limited additional extractions are technically feasible, and would not contribute to seawater intrusion, if properly located and managed. Management of water levels in the coastal portion of the aquifer is important because the aquifer is in direct communication with

the ocean at the coast, where a "bedrock notch" exists in the subsurface of the river's mouth. Maintenance of a seaward hydraulic gradient in the coastal portion of the aquifer is required to repel seawater intrusion into the aquifer.

However, the report indicated that increased pumping, without surface flows to replace depleted storage, could result in significant impacts to the Carmel River lagoon. Increased pumping could diminish the hydraulic head in the area, reduce the volume of ground-water discharge, and lower ground-water levels in the lagoon, as well as increase water salinity and temperature. Potential impacts to the health of riparian vegetation and interference with operation of other wells were also identified as possible results of increased pumping in aquifer subunit 4.

Based on these preliminary studies as well as the CVSIM results described in the following paragraph, the Board voted to exclude additional pumping in subunit 4 as an integral component to any water supply alternative. It should be noted that additional facilities could be needed in this area at buildout to comply with State Department of Health Services requirements for meeting peak daily demand and water treatment.

Revisions to CVSIM Computer Model

Based on the findings of SGD, District staff revised the CVSIM model code in April 1989 to more accurately represent the aquifer subunit 4 (AQ4) system and the management needed to prevent seawater intrusion. In addition, coding corrections and refinements to the model were made to better reflect probable "real time" operations. Numerous simulations were made for various alternatives to assess the impact of the new aquifer subunit 4 information as well as performance of alternatives with and without new AQ4 wells. These results were presented to the District Board at its May 8, 1989 regular meeting. Based on this information, the Board voted not to include new wells in aquifer subunit 4 as an integral component of any alternative.

New Wells in Aquifer Subunit 2

Previous evaluations assumed inclusion of new Cal-Am wells in aquifer subunit 2 (AQ2). This reach occurs between the USGS Robles gage and the Scarlett Narrows, and is considered as valuable steelhead and riparian habitat. Cooperative efforts between the District, Cal-Am and California Department of Fish and Game have been made to reduce impacts of water supply practices on AQ2

as much as possible. Computer simulations performed in late 1989, and data collected in Summer 1989 and 1990 indicate that pumping new wells could adversely affect the river in the AQ2 area. Thus the Board voted to exclude new wells in AQ2 as an integral component of any project alternative. It should be noted that existing wells would be nominally used as part of each alternative, and only maximized in severe drought periods.

Inundation of Ventana Wilderness

An important issue for the New Los Padres alternative was whether permission to inundate three to four acres of Ventana Wilderness could be obtained or whether the Wilderness boundary could be changed. In early 1989, the District initiated a dialogue with representatives from the U.S. Forest Service (USFS) regarding this issue. Given the uncertainty at that time, the District Board directed staff to analyze a 9,000 AF New Los Padres Dam in the Supplemental Draft EIR/EIS. This alternative reflected the largest reservoir at the New Los Padres dam site that could be built without inundating the existing Ventana Wilderness lands. This project was originally combined with dredging of both reservoirs to original capacity.

In October 1989, the House of Representatives passed HR 1473, a bill that included a minor boundary change in the Ventana Wilderness to facilitate construction of the New Los Padres project. A similar bill (HR 5433) was passed by Congress in October 1990. The President signed Public Law 101-539 in November 1990, which would amend the Wilderness boundary if a larger New Los Padres Reservoir alternative is permitted.

Cañada Reservoir

On February 13, 1989 a consortium of private landowners and Cal-Am made a presentation to the District Board on their intention to separately pursue construction of Cañada Reservoir. This project entails diversion of water from the Carmel River during high flow periods and pumping to an offstream reservoir of about 25,000 AF in size.

The Cañada site was not evaluated by the District in its Part I and Part II alternatives evaluations because an early investigation of potential reservoir sites performed in 1980 dismissed a dam in Cañada de la Segunda.[9] This assessment was based primarily on the poor ratio of dam height to storage volume ratio, assuming a reservoir size range of 3,000 to 5,000 AF. Other technical concerns

related to the presence of the Navy earthquake fault and the suitability of native fractured shale with which to build an embankment dam. A 1989 assessment showed that the height-to-volume ratio is much better than the earlier assessment when the proposed reservoir size of 25,000 AF is considered.[10] Studies were performed in late 1989 and early 1990 to confirm the site feasibility, assess potential seepage rates, address identified geotechnical and hydrologic concerns, and develop more accurate cost estimates.[11,12]

The MPWMD assisted Cal-Am to develop a more definitive project description and operations scenario by January 1991, based on simulations from the District's CVSIM computer model. In addition, Cal-Am requested that the District be the lead agency for the EIR/EIS on the Cañada project in October 1990. Thus, the 25,00 AF Cañada Project was analyzed in the 1991 SD EIR/EIS.

Desalination

As a result of the continuing drought, the MPWMD Board began a Near-Term Water Supply Program in December 1989. The program's purpose is to develop additional water supplies to sustain the community until a long-term project could be constructed. A 3 MGD desalination project is being pursued as part of this program because it can be implemented relatively quickly (three to four years), and would provide a more reliable supply for existing users and near-term growth.

As the drought continued into 1990 and 1991, it became apparent that a desalination component may be needed to improve the water supply performance of a reservoir project during extended periods of drought. Three reservoir alternatives were eventually combined with a 3 MGD desalination plant, and a stand-alone 7 MGD desalination plant was selected as the "non-dam" alternative for the 1991 SD EIR/EIS.

These alternatives entailed desalination on a conceptual basis, with production from a non-specific source simulated in the CVSIM model. The District initiated a Desalination Feasibility Study of seven potential sites in early 1991.[13] The study was completed in July 1991, and recommended that two sites be analyzed further: the PG&E power plant site at Moss Landing and the MRWPCA Regional Treatment Plant site near the City of Marina. A third alternative located in Sand City was also recommended based on new information on site availability. A Near-Term Desalination Project EIR and Preliminary Design report were prepared on these three alternatives in 1992. The Sand City alternative was selected as the preferred project.

MPWMD Board Action in 1990 and 1991

In August 1990, the District Board held a public workshop on the EIR/EIS. Pertinent decisions included (1) amending the basic project purpose to include only water supply elements, (2) determining to delay release of the Supplemental Draft EIR/EIS until Cañada Reservoir could be adequately described and analyzed, and (3) combine a 9,000 AF New Los Padres Reservoir with a 3 MGD desalination plant instead of dredging. The latter action was taken due to the greater cost-effectiveness and better water supply performance with desalination, and concerns about the environmental impacts of dredging. Dredging was similarly replaced by a desalination plant for the 6,000 AF Cachagua Creek alternative as well. In March 1991, the 16,000 AF New Los Padres Reservoir with 3 MGD desalination was added to the list of alternatives to be analyzed in the SD EIR/EIS. This intermediate size was added due to the approval of the Ventana Wilderness land exchange (which would allow a larger reservoir) as well as concerns about the deleterious environmental effects of reduced instream flow with the 9,000 AF reservoir size.

Alternatives Evaluated in 1991 SD EIR/EIS

Based on the studies and actions described above, the projects that were recommended in the Part II analysis (November 1988) were subsequently amended to those that were analyzed in the 1991 SD EIR/EIS. They included:

- 24,000 AF New Los Padres Reservoir
- 16,000 AF New Los Padres Reservoir plus 3 MGD desalination
- 9,000 AF New Los Padres Reservoir plus 3 MGD desalination
- 23,000 AF New San Clemente Reservoir
- 11,000 AF San Clemente Creek Reservoir with pumped storage
- 10,500 AF Chupines Creek Reservoir with pumped storage
- 6,000 AF Cachagua Creek Reservoir plus 3 MGD desalination
- 25,000 AF Cañada Reservoir
- 7 MGD desalination plant
- No Project

3.5 ALTERNATIVES SELECTED FOR DETAILED ANALYSIS IN SD EIR/EIS-II (1992)

The following paragraphs briefly review how the five alternatives evaluated in detail in this revised Supplemental Draft EIR/EIS-II were selected. The five alternatives include:

- 24,000 AF New Los Padres Reservoir
- 24,000 AF New Los Padres Reservoir plus 3 MGD desalination plant located in Sand City
- 15,000 AF Cañada Reservoir plus 3 MGD desalination plant located in Sand City
- 7 MGD capacity desalination project, built in two stages, and comprised of a 3 MGD plant at Sand City and a 4 MGD plant at the MRWPCA site near the City of Marina
- No Project (expected facilities and conditions in 1993)

Chapter 20 of the 1991 SD EIR/EIS explains why the 9,000 AF New Los Padres, 23,000 AF New San Clemente, 11,000 AF San Clemente Creek, 10,500 AF Chupines Creek, 6,000 AF Cachagua Creek, 25,000 AF Cañada Reservoir, and 7 MGD desalination alternatives were not considered to be feasible.

<u>24,000 AF New Los Padres Reservoir Alternatives</u>

The 24,000 AF New Los Padres Reservoir is the proposed project for the federal Section 404 Permit as well as the State Water Resources Control Board's Water Rights Application. Also, the 1991 SD EIR/EIS tentatively identified the overall preferred project as a New Los Padres Reservoir ranging in size from 16,000 AF to 24,000 AF. Thus, the 24,000 AF reservoir represents the largest size of reservoir that the District would construct.

The 16,000 AF New Los Padres Reservoir plus 3 MGD desalination alternative was evaluated as a feasible project in the 1991 SD EIR/EIS. It represented a means to reduce inundation effects, and provide adequate water supply and some instream benefits. The project description assumed that two new wells in the Seaside Coastal Groundwater Subbasin would be developed by Cal-Am. The SD EIR/EIS noted that optimization of project operations, refinements to the CVSIM code and incorporation of water year 1991 data may result in a reservoir size other than 16,000 AF.

In early 1992, District and resource agency staff agreed to form a Fisheries Working Group (FWG) to develop a revised operations scenario for the New Los Padres Project that would address concerns

noted in agency comments on the 1991 SD EIR/EIS. The FWG developed new fishery requirements that were more rigorous and entailed greater winter releases than those used in 1991.

By September 1992, assumptions about the project description and operations had changed from those used in 1991. Only one new well in the Seaside Coastal area (Paralta Well) was assumed for the project (rather than two). The revised operations reflected four primary goals: (1) improvement of fishery release schedules as recommended by the FWG; (2) protection of the river reaches associated with aquifer subunits 1 and 2 by reduced pumping in those areas; (3) more explicit protection against seawater intrusion in lower Carmel Valley by restrictions on usable storage available for pumping in aquifer subunit 4; and (4) demand management that reflects the District Board's desire to require no more than voluntary rationing (10% reduction) in a severe drought similar to the 1987-92 event.

In order to minimize groundwater pumping from subunits 1 and 2, the FWG suggested that the District re-consider its policy excluding additional groundwater development in subunit 4 of the Carmel Valley aquifer and further explore the possibility of developing additional production wells in the lower reaches of the river. Development of a well in this area would be closely monitored. As described in Section 4.6.1, Groundwater Development by Cal-Am, it was assumed that Cal-Am would reconstruct or replace three existing production wells in subunit 3 and develop a new production well in subunit 4 for the 24 NLP, 24 NLP/D, and 15 CAN/D simulations in the SD EIR/EIS-II. No additional groundwater production capacity in the Carmel Valley was assumed for the 7 DSL or NO PRJ simulations.

The increased production capacity would be sufficient to meet maximum day demand under buildout conditions. The new well in subunit 4 would also provide greater system reliability in this area and would enable Cal-Am to extract a greater proportion of its supply from downstream sources. Operation of this new well and the existing well (i.e. Cañada Well) in subunit 4 would be closely monitored and production would be curtailed to provide the necessary protection against seawater intrusion.

These changes resulted in the conclusion that a 24,000 AF New Los Padres Reservoir plus a 3 MGD desalination plant would be needed to meet the rigorous water supply performance standards and provide significant quantities of water for instream releases as recommended by the FWG, at buildout

demand levels (22,750 AF annual Cal-Am production in a normal year). It should be noted that the California Department of Fish and Game, in its comment letter on the SD EIR/EIS, specifically requested that the District analyze a 24,000 AF New Los Padres Reservoir combined with desalination.

15,000 AF Cañada Reservoir/Desalination Alternative

The 1991 SD EIR/EIS concluded that the 25,000 AF Cañada Reservoir was not feasible, primarily due to its extremely high cost. However, state and federal agency reviewers of the 1991 SD EIR/EIS requested that the District continue to investigate a smaller Cañada Reservoir combined with a desalination plant; the District is complying with that request. The 15,000 AF size was selected as it allows a reduction in cost, provides reasonable water supply and would result in no worse conditions in the Carmel River than currently exist. In 1992, the District retained Cal-Am to develop revised cost estimates and preliminary design information for the smaller reservoir. Thus, the 25,000 AF reservoir analyzed in 1991 has been replaced by the 15,000 AF reservoir combined with a 3 MGD desalination plant for analysis in this SD EIR/EIS-II.

7 MGD Desalination Alternative

The 1991 EIR/EIS concluded that the 7 MGD "stand-alone" desalination plant was not feasible due to numerous cost uncertainties, questionable site availability for a 7 MGD plant, and logistical constraints concerning District boundaries that existed at that time. (In 1991, only two alternatives were considered -- one near Marina and one in Moss Landing.) Due to the uncertainties about desalination, agency reviewers requested that the District continue to consider this alternative.

In 1992, a 3 MGD desalination plant located in Sand City was evaluated as part of the District's Near-Term Water Supply Program (see Section 2.5.10 for more information). The project goal of the 3 MGD plant is to supplement existing water supply resources, provide additional system reliability to protect against future drought periods and provide water to meet the needs of near-term growth. The project would be capable of producing up to about 3,000 AF per year. A Draft and Final EIR were completed in addition to a preliminary design report that provides more detailed information on the project description and cost estimates at three alternative sites.[14,15] Based on these and other reports, the District concluded that the Sand City site is the preferred alternative.

An authorizing election to approve a Near-Term Desalination Project is scheduled to occur in June 1993.

Assuming that a Near-Term Desalination Project at Sand City is approved by voters, the District determined for the purposes of this SD EIR/EIS-II that the 7 MGD desalination alternative would entail construction of two desalination plants in two phases -- a 3 MGD plant at Sand City in the year 1995, and a 4 MGD plant at the MRWPCA site near Marina in about the year 2005. Two separate locations are required because the Sand City site cannot support more than 3 MGD of production.

No Project Alternative

The No Project alternative description has changed from that evaluated in the 1991 SD EIR/EIS. The 1991 No Project description estimated what future conditions would be without a significant new water supply project; it assumed that two new wells in the Seaside Coastal area would be drilled, and set a Cal-Am production limit of 20,000 AF annually. Agency and other reviewers stated that the No Project alternative should better reflect existing conditions. Thus, the No Project alternative in this SD EIR/EIS-II reflects conditions expected in 1993 -- additional supply from the new Cal-Am well in Seaside (Paralta Well), and a production limit of 17,359 AF annually for the Cal-Am system.

The project description for each of the five alternatives analyzed is found in Chapter 4. Each alternative description, including the No Project alternative, entails the District's comprehensive, long-term conservation program that includes the Pebble Beach reclamation project. Each project, including the No Project alternative, also assumes that Cal-Am's new Paralta well in Seaside will be operational by mid-to-late 1993.

Only conceptual information on Cal-Am facilities that may be needed in the future is available. These facilities are described in Section 4.6 and included to more accurately portray the cost of future facilities, with or without a long-term water supply project. The site-specific impacts of any new Cal-Am facilities or programs will be subject to the formal environmental review process when they are proposed by Cal-Am at some future point in time.

3.6 404(b)(1) COMPLIANCE EVALUATION

In July 1991, the District prepared a Draft 404(b)(1) Compliance Evaluation for the U.S. Army Corps of Engineers. This document determined, among other things, which of the 10 alternatives evaluated in the 1991 SD EIR/EIS are "practicable" as defined in Section 404 of the Clean Water Act, based on more accurate costs, technical and other information received since 1988. The 404(b)(1) Compliance Evaluation concluded that the three largest Carmel River mainstem reservoirs (New Los Padres and New San Clemente Reservoirs) evaluated in the 1991 EIR/EIS are practicable because they meet the basic water supply purpose at a reasonable cost. The remaining alternatives, including the No Project option, were not considered to be practicable because they fail to meet the water supply purpose, are too costly, have questionable site availability and/or are constrained by logistical factors. However, they were analyzed in the SD EIR/EIS at a similar level of detail.

A revised Draft 404(b)(1) Compliance Evaluation was prepared in February 1993, and is on file in the Corps' San Francisco office. The evaluation concludes that only the two New Los Padres Reservoir alternatives are practicable. The remaining alternatives are considered to not be feasible; please see Chapter 20 of this document for more information.

<u>23,000 AF New San Clemente Project</u>

The 1991 404(b)(1) evaluation determined that the 23,000 AF New San Clemente Reservoir was practicable as it met water supply and instream flow requirements. However, it would have the greatest inundation impacts of all alternatives and appears to be infeasible as long as the New Los Padres Project is considered viable. At the Interagency Group Meeting hosted by Rep. Leon Panetta in February 1989, all federal and state agency representatives, including those from the Army Corps of Engineers, stated that the New San Clemente Project would not receive a 404 Permit because the New Los Padres Project represented a feasible alternative with less adverse environmental effects. Thus, the New San Clemente Project is not considered to be practicable due to this institutional (regulatory) constraint, and was not evaluated in the 1993 SD EIR/EIS-II. This alternative would be reconsidered if the New Los Padres Dam were found to be infeasible.

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1. Environmental Protection Agency, Amended Section 404 (b) (1) <u>Guidelines for Specification or Disposal Sites for Dredged or Fill Material</u>, Part 230 (40CFR 230), 1977.

2. Federal Register, Discussion of Section 404 of the Clean Water Act, Volume 45, No. 249, pg. 85339, December 24, 1980.

3. California Environmental Quality Act Guidelines, Section 15126 (d), January 1984.

4. MPWMD, Evaluation of Water Supply Alternatives for the New San Clemente Project Supplemental Draft EIR/EIS -- Part 1: Assessment of Practicability, Final Report, September 19, 1988.

5. MPWMD, Evaluation of Water Supply Alternatives for the New San Clemente Project Supplemental Draft EIR/EIS -- Part II: Assessment of Performance, Draft Report, November 21, 1988.

6. Bechtel Civil, Preliminary Design and Cost Estimates -- New Los Padres, New San Clemente and San Clemente Creek Projects, June 1989.

7. Staal, Gardner and Dunne, Hydrogeologic Investigation, Carmel River Aquifer -- Coastal Portion, May 1989.

8. Clark, Joseph, Geologic Analysis of the Cypress Point Fault in the Vicinity of the Lower Carmel River Valley, Letter report to MPWMD, March 9, 1989.

9. Logan, John, Reconnaissance Study of Off-Channel Reservoirs, Carmel River Basin, February 1988.

10. Grice Engineering, Preliminary Investigation and Evaluation of Cañada Reservoir, May 1989.

11. Brown and Caldwell, Cañada Reservoir Project; Phase 1A - River Diversion Study. Prepared for Cal-Am Water Co., March 1990.

12. Brown and Caldwell, Cañada Reservoir Project; Phase 1B - Dam and Reservoir Geotechnical Investigation. Prepared for Cal-Am Water Co., July 1990.

13. Boyle Engineering Corporation, Desalination Feasibility Study, prepared for MPWMD, July 1991.

14. Near-Term Desalination Project Draft EIR, April 1992. Final EIR, December 1992. Prepared for MPWMD by EIP Associates.

15. James M. Montgomery Engineers, Desalination Preliminary Design, Final Report, prepared for Monterey Peninsula Water Management District, March 1992.

4. DESCRIPTION OF PROJECTS ANALYZED IN THE EIR/EIS

4. DESCRIPTION OF PROJECTS ANALYZED IN THE EIR/EIS

MPWMD staff evaluated a broad range of water supply improvement alternatives before identifying the five alternatives discussed in this Supplemental Draft EIR/EIS-II for more detailed evaluation. Chapter 3 discusses the full range of alternatives considered, together with a description of the process used to select the alternatives that are evaluated in detail. The five alternatives described in this chapter include two projects at one dam site on the Carmel River, one off-stream reservoir, desalination (non-dam alterative), and the No Project alternative. The description in this chapter addresses the Carmel River dams first (New Los Padres Reservoir alternatives), followed by the off-stream reservoir (Cañada Reservoir), desalination, and the No Project alternative. The locations of the alternatives examined in this document are shown in Figure 4-1.

4.1 24,000 AF NEW LOS PADRES RESERVOIR (24 NLP)

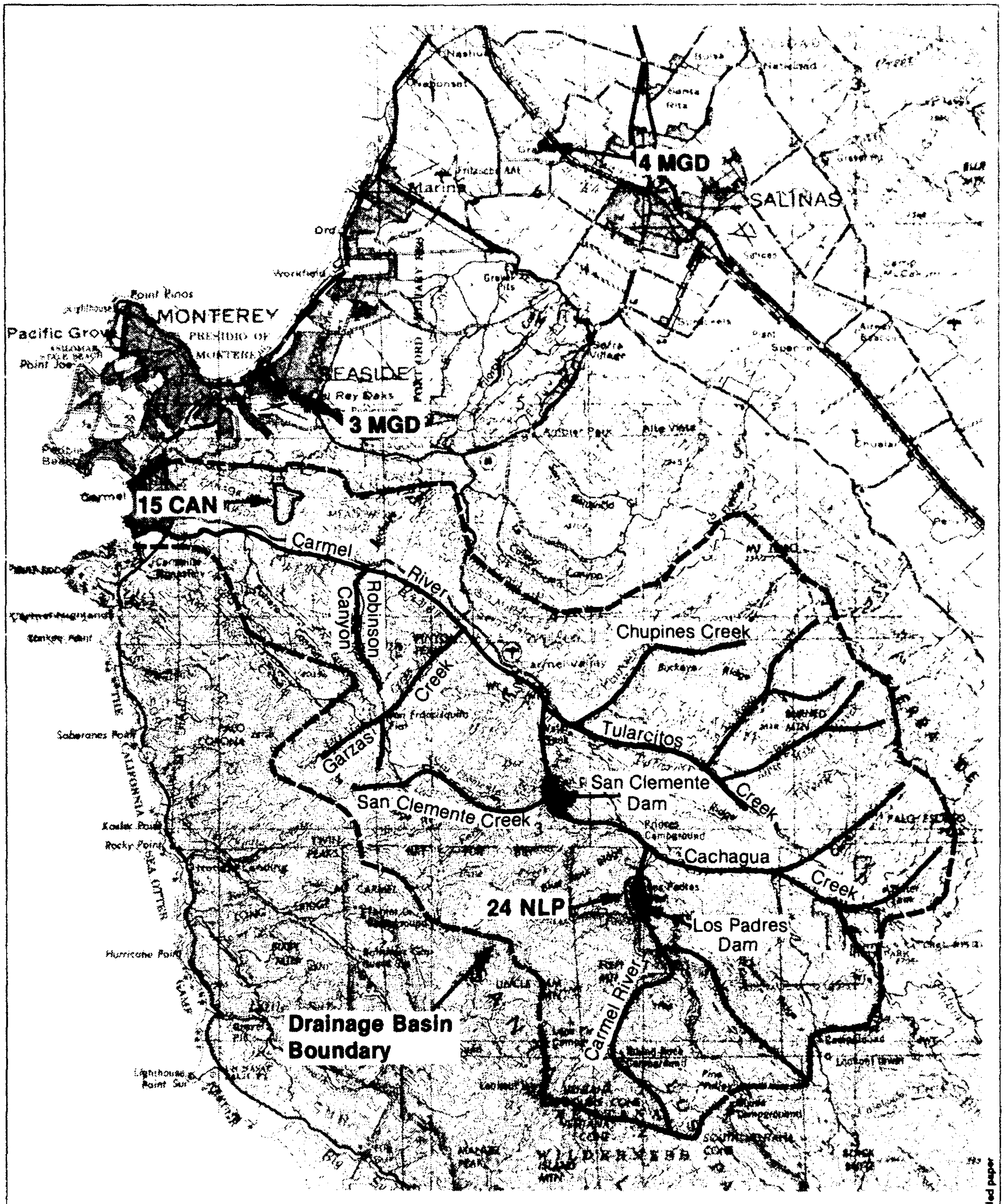
The New Los Padres Dam would be located on the Carmel River approximately 19 miles southeast of the City of Monterey and 7 miles southeast of Carmel Valley Village. The new dam would be about 2,400 feet downstream of the existing Los Padres Dam and 24 river-miles upstream from the mouth of the Carmel River at Carmel Bay (Figure 4-1). The new reservoir would completely inundate the existing Los Padres Dam and Reservoir. A more detailed description may be found in Bechtel's 1989 preliminary design and cost estimate report.[1] Refinement of the project design has indicated that the dam would need to be about 10 feet higher than shown in the 1991 SD EIR/EIS to provide 24,000 AF of storage.[2]

4.1.1 PHYSICAL CHARACTERISTICS

The New Los Padres Dam would be a 274-foot-high roller-compacted concrete (RCC) dam measuring approximately 1,600 feet along its crest. The top of the dam would be at an elevation of 1,140 feet, and the spillway crest and normal maximum water surface would be at an elevation of 1,130 feet. A plan view of the proposed dam is shown in Figure 4-2, while a cross-section through

LOCATION OF WATER SUPPLY ALTERNATIVES

FIGURE 4-1



SOURCE: USGS 1 : 250,000 MONTEREY

MILES 0 2.5 5

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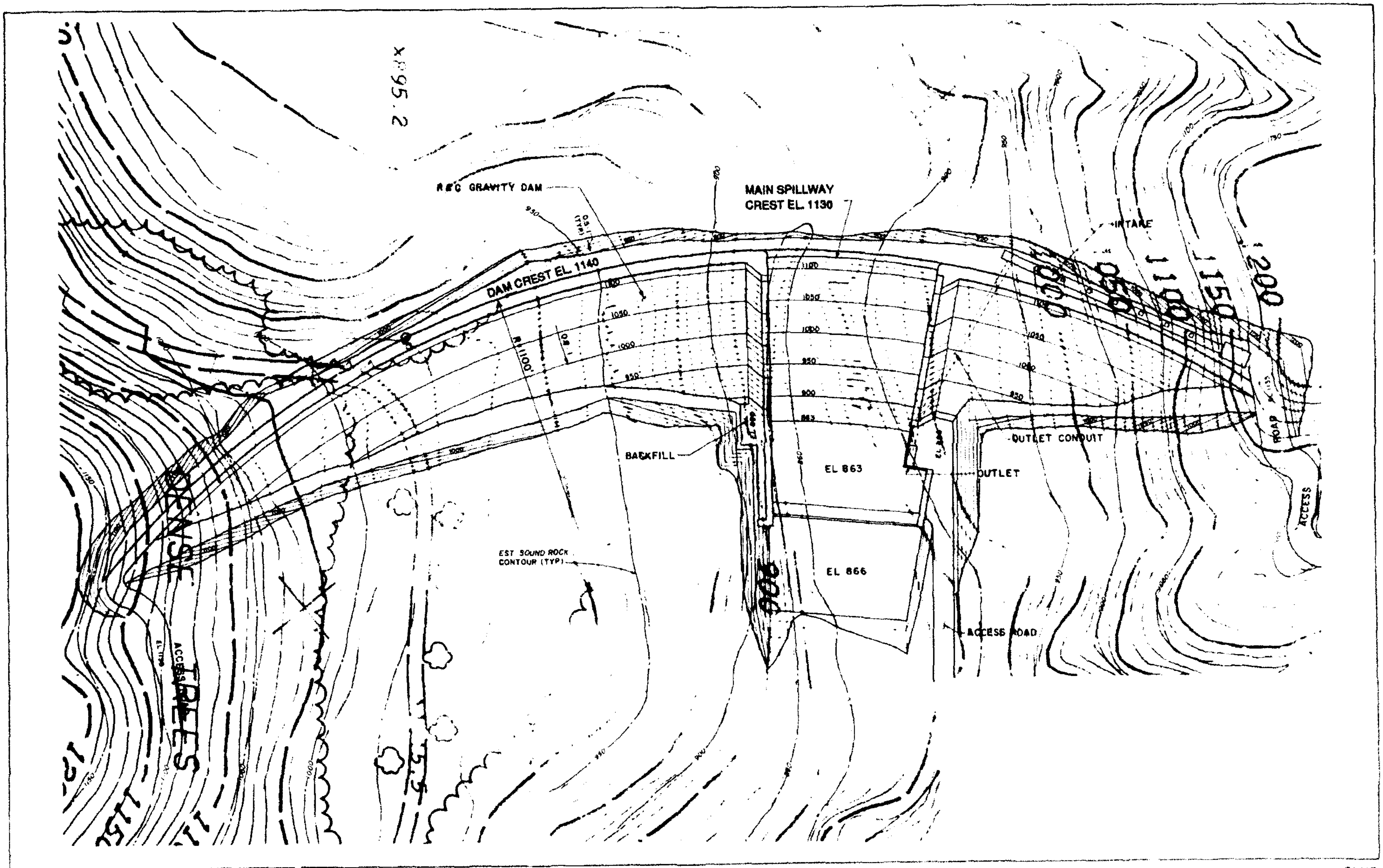
PLAN VIEW OF 24,000 AF NEW LOS PADRES DAM

FIGURE 4-2



SOURCE: BECHTEL CIVIL, INC.

FEET 0 100 200

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the dam is shown in Figure 4-3. The type of dam recommended for the New Los Padres site would be a curved gravity roller-compacted concrete (RCC) structure.[3] The gravity-type structural section is designed to remain stable against all overturning and sliding forces. The curved configuration causes arching action to develop, which results in a structure that can resist the loads applied to it with a greater margin of safety. The dam would be designed to withstand the maximum credible earthquake on nearby faults and to meet all requirements of the State Department of Water Resources, Division of Safety of Dams (DSOD). (See Chapter 6, Geology and Seismicity, for more information.)

The reservoir formed by New Los Padres Dam would provide 24,000 AF of gross storage at the spillway crest elevation of 1,130 feet. A volume of 2,000 AF would be reserved to accommodate sediment that washes down from the watershed tributary to the dam site and initially serve as a minimum pool for the resident lake fishery, leaving 22,000 AF of usable or "active" storage. The surface area of the reservoir would be 266 acres at an elevation of 1,130 feet. A plan view of the proposed reservoir is shown in Figure 4-4.

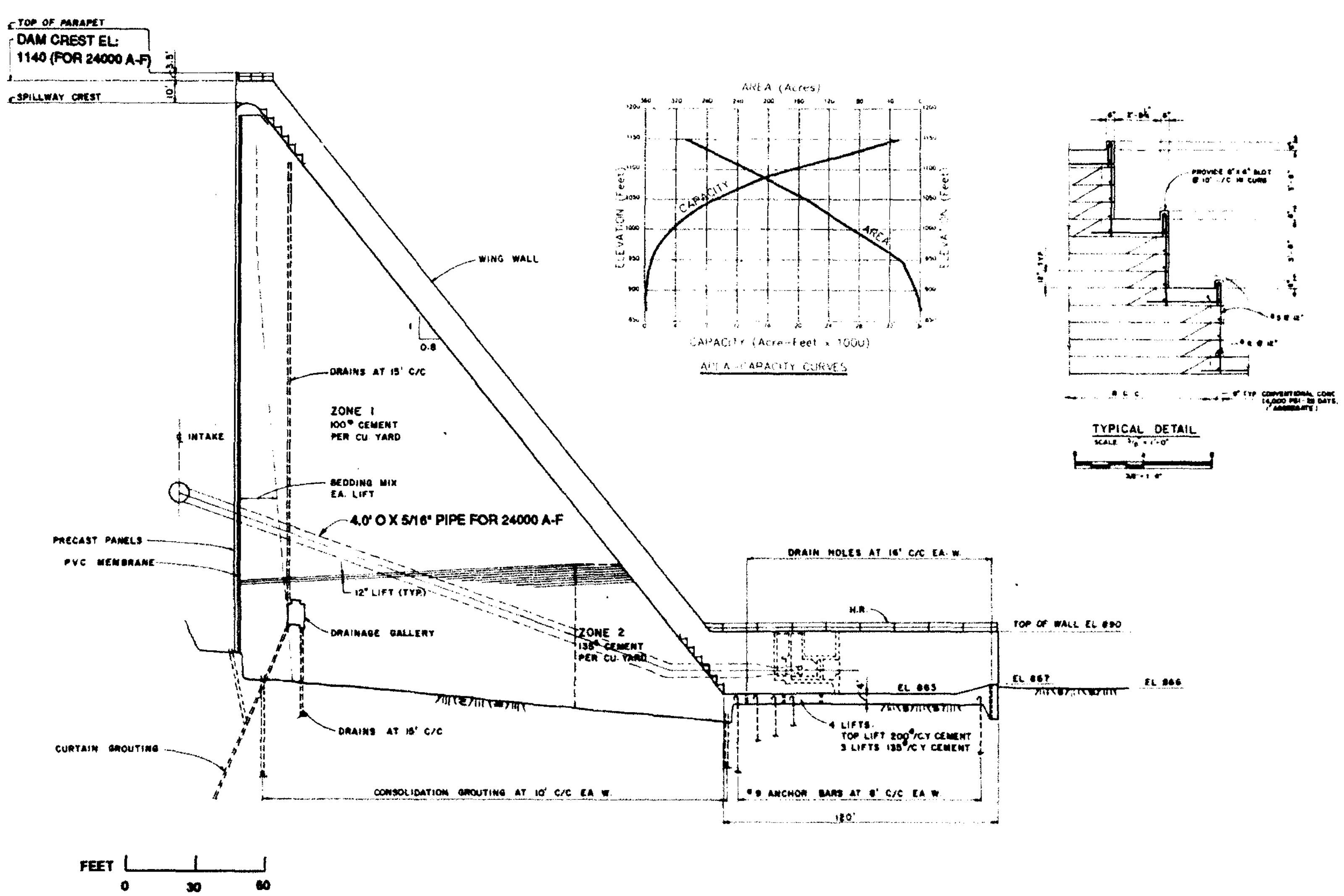
The proposed 24,000 AF reservoir would inundate four acres and impact another 19 acres of land within the Ventana Wilderness. Public Law 101-539, signed by President Bush in November 1990, calls for the MPWMD to donate about 140 acres of private land adjacent to the Ventana Wilderness (Parcel B) in exchange for the 23 acres of land that would be affected by the project (Parcel A), as shown in Figure 4-4. Thus, a net increase of 117 acres of high-quality wilderness lands along Danish and Rattlesnake Creeks would be added to the existing Wilderness area.

Most of the proposed reservoir inundation area is covered with heavy scrub or trees that would be selectively removed to an elevation of about 1,135 feet. Timber would be harvested and used for lumber and firewood. The remaining spoils would be disposed of, either by burning, consumption by goats and/or hauling.

A spillway would be constructed near the center of the dam to allow water in excess of the dam's outlet works' capacity to pass safely over the dam. The spillway would consist of a 215-foot-wide overflow structure and would include a stilling basin at the downstream toe of the dam to prevent erosion of the river banks. The spillway capacity is 35,000 cfs, which is the estimated probable maximum flood (PMF) as determined by the U.S. Army Corps of Engineers.[4]

SECTION VIEW AND AREA - CAPACITY CURVES FOR 24,000 AF NEW LOS PADRES DAM AND RESERVOIR

FIGURE 4-3



SOURCE: BECHTEL CIVIL, INC.

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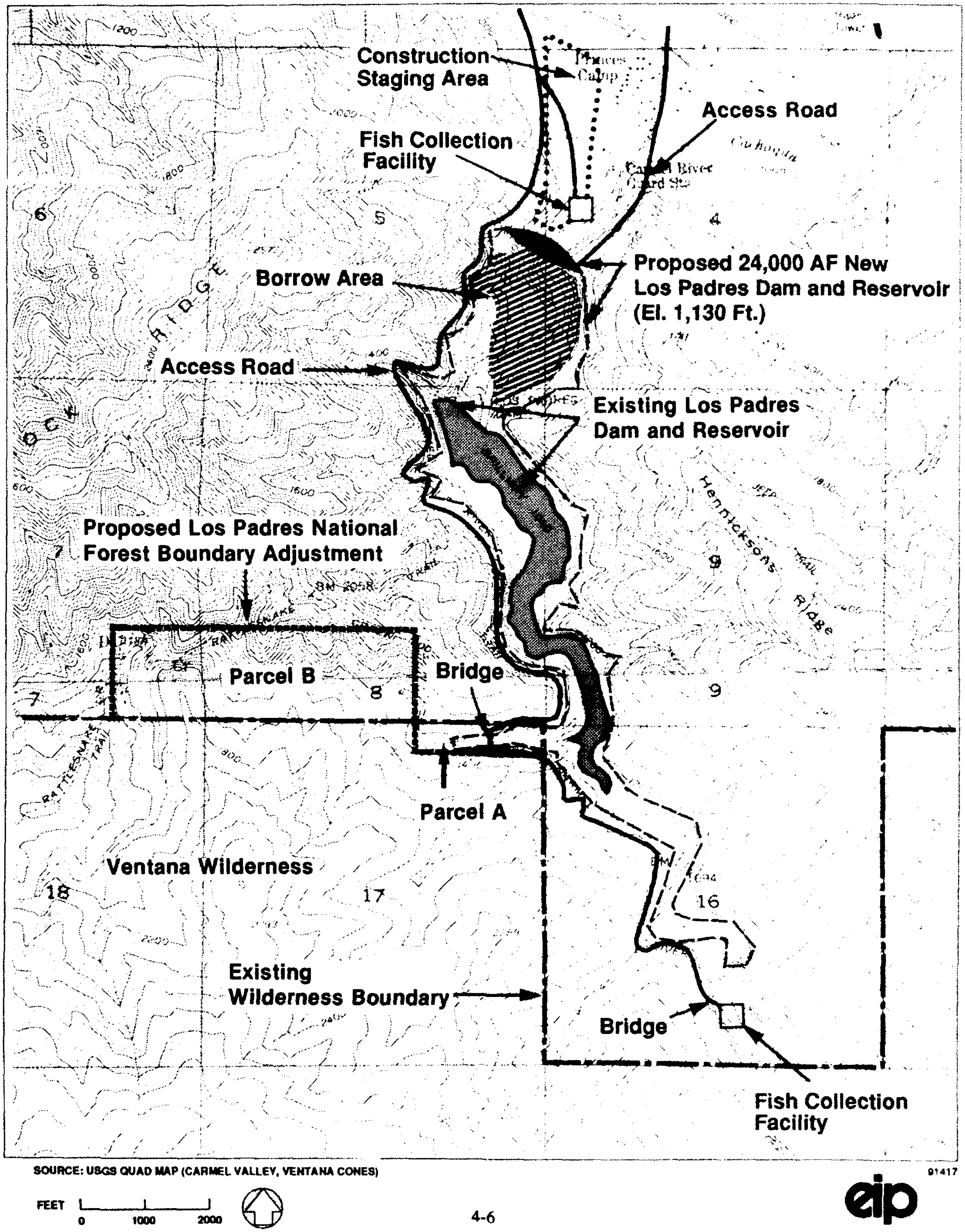
PROPOSED 24,000 AF NEW LOS PADRES DAM AND RESERVOIR

FIGURE 4-4



SOURCE: USGS QUAD MAP (CARMEL VALLEY, VENTANA CONES)

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A multiple-level intake would be built at the upstream face of the dam to allow water to be released to the river below. The multiple withdrawal levels allow water to be released from different reservoir elevations so that optimum water quality or temperature can be selected.

Migrating fish would be accommodated during both upstream and downstream migration. A trap and truck system would be used to pass upstream migrating adult steelhead trout around the dam. Upstream migration facilities would consist of a fish weir and ladder between the dam and Princes Camp, a trapping and holding facility, and a specially equipped tank truck for hauling. Downstream migration of spent adults and smolts would be accomplished through the use of a screening facility located upstream of the reservoir. Carmel River flows of up to about 450 cfs would be diverted through the screening facility, and steelhead would be transported by truck downstream of the new dam. At flows greater than 450 cfs, the diversion gates would be raised to allow water, sediment and debris to bypass the screening facility. Any fish moving at this time would enter the reservoir. Additional detail is provided in Chapter 8, Fish and Aquatic Life.

Permanent access roads would be constructed for the project. A road would extend from the gate between Princes Camp and the existing Los Padres Dam to the top of the dam on the right (east) abutment. A second road would extend from Cachagua Road west of Princes Camp, across the river to the left (west) bank, past the dam, to the fish screening facilities approximately three miles upstream (south), as shown in Figure 4-4. Temporary roads used for access during construction would be unpaved. Permanent access roads would be unpaved with the possible exception of the road to the fish passage facility near the upstream end of the reservoir. Detailed alignments of these roads would be developed during final design of the project.

The road linking Cachagua Road to the easterly access road would be the existing road through Princes Camp. This road, including the bridge across Cachagua Creek, would be widened and improved during construction in order to accommodate heavy trucks and equipment.

4.1.2 PROJECT CONSTRUCTION

Schedule

Construction of the New Los Padres Dam would take an estimated twenty-two months. The first ten months of construction would include the mobilization of construction equipment, construction of

haul and access roads to the dam site and borrow area, clearing and grubbing of the reservoir inundation area, excavation for the dam foundation and borrow area, consolidation grouting, testing and processing of aggregate for the dam, installation of the concrete batch plant, and preparation of the dam foundation.

The 24 NLP dam and appurtenant structures could then be constructed in the following ten-month period. The actual construction of the dam is estimated to require six months. Work at the dam site during the construction phase would consist of 24-hour days comprised of two ten-hour shifts, five days per week. The four-hour period when active RCC placement was not occurring would be used for equipment maintenance and site preparation.

The final two months of the construction schedule would be devoted to demobilization of construction equipment and restoration of the construction staging area.

Construction Method

The relatively short construction period of the proposed 24 NLP reservoir and dam is attributable to the construction method chosen – roller compacted concrete, or "RCC." The RCC method of dam construction provides substantial savings in both time and cost compared with conventional concrete. Mass concrete with a low cement and water content is used as the major building material. RCC is hauled, spread in layers, and compacted by earthmoving equipment such as front-end loaders, bulldozers, and vibratory rollers. It is placed in an almost continuous operation, rather than the section-by-section placement used with conventional concrete.

The RCC method usually entails construction of a test section to monitor construction techniques, materials, and results before proceeding with the major structure. In this case, the test section would be built at the site of the steelhead trap-and-truck facilities located downstream of the dam. The test section would form the fish barrier and part of the ladder structure.

Crushed rock for the RCC mix would be obtained from one or more quarries located upstream (south) of the proposed dam site, between the existing Los Padres Dam and the proposed New Los Padres Dam. The most promising quarry site for the New Los Padres project is a terrace deposit located approximately 1,000 feet upstream of the dam site on the west bank of the Carmel River. This quarry site is entirely within the New Los Padres Reservoir inundation area. Cement, pozzolan

(or "fly ash" used in the RCC mix for workability and strength) and other construction materials would be hauled to the site by truck. Truck traffic would be limited to daylight hours.

Water for the RCC mix would be pumped from the Carmel River. Water use for dam construction would range from 68,000 gallons per day (gpd) to 548,000 gpd if aggregate must be washed. These volumes equate to 0.10 to 0.85 cubic feet per second (cfs), respectively, over a 24-hour period. Because Carmel River inflow measured upstream of the existing Los Padres Dam has fallen below 1.0 cfs in late summer during the recent drought, it is possible that water supply for dam construction would need to be augmented by trucking, conventional wells or radial wells at the damsite if a similar drought occurred during dam construction. There would be more than enough water for dam construction in all other situations.

Construction Staging Area

A construction staging area would be located downstream (north) of the proposed dam site on the west bank of the Carmel River, as shown in Figure 4-5. For the 1991 SD EIR/EIS it was assumed that the construction staging area would be located upstream of the new dam, within the inundation area of the new reservoir. However, further refinement of the construction scenario resulted in the relocation of the construction staging area below the dam site and outside of the inundation area. This was primarily because of the lack of space upstream of the new dam. While marginally sufficient flat land exists between the dams to allow for construction staging, other factors combine to make this infeasible, including the fact that the borrow areas and quarry sites for construction materials for the new dam are located in this area; crushing and processing of borrow and quarry materials would occur in this area; a construction staging area upstream of the new dam would be subject to an increased risk of inundation during a flood event; siting and operation of the required sedimentation ponds would be virtually impossible; and demobilization of construction equipment would be considerably more difficult.

The construction staging area would consist of permanent and construction access roads, sedimentation ponds, aggregate storage, heavy equipment parking and maintenance areas, contractor's laydown and storage areas, cement storage silos, a concrete batch plant, conveyor belts, and a compressor house (see Figure 4-5). It is estimated that the staging area would be 19 acres in size; the acreages of the staging area components are listed in Table 4-1. The components of the staging area are discussed in further detail below.

TABLE 4-1

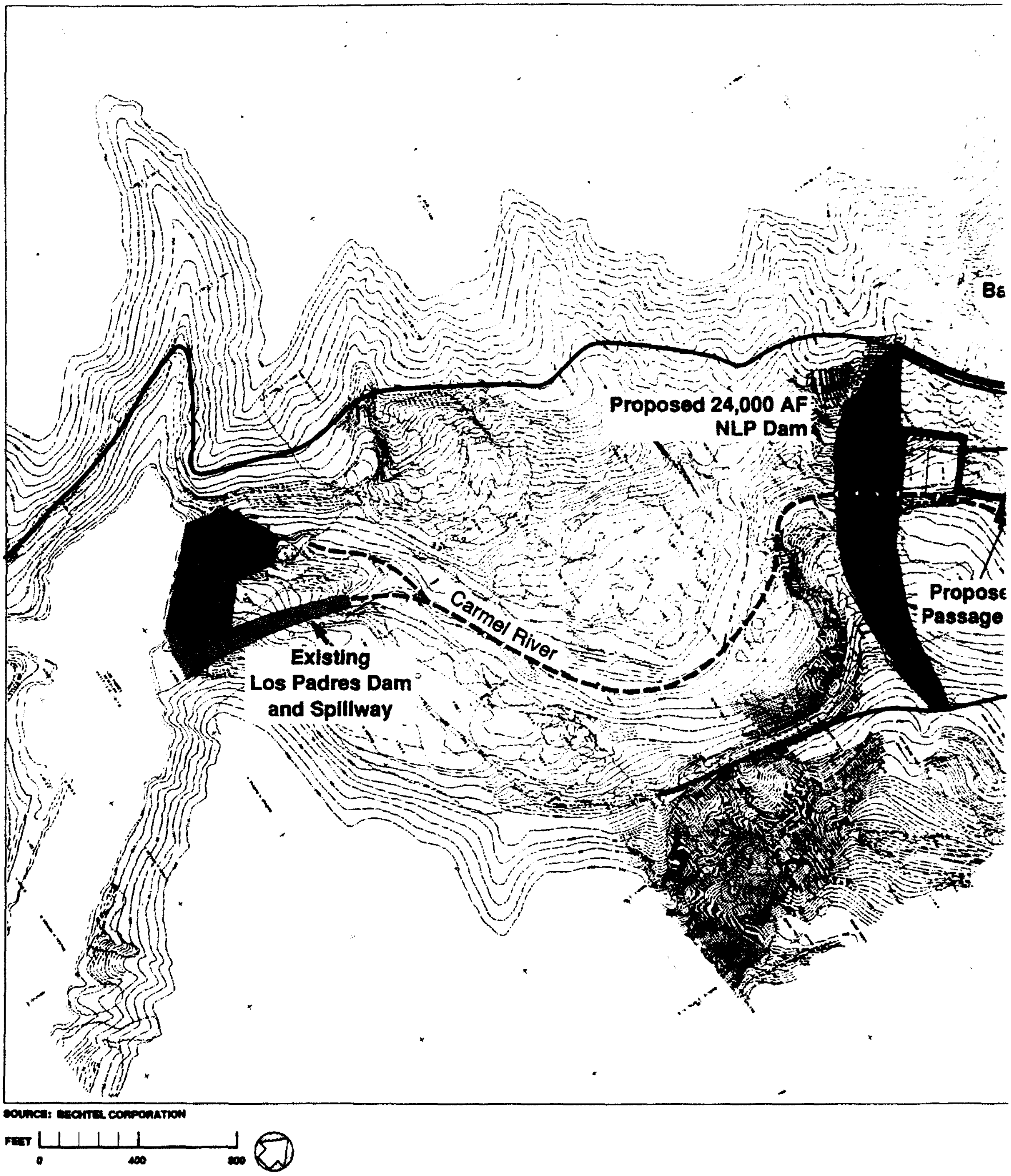
COMPONENTS OF THE CONSTRUCTION STAGING AREA FOR THE 24 NLP RESERVOIR AND DAM (ACREAGES)

Staging Area Component	Size (Square Feet)	Size (Acres)
Aggregate Storage	360,000	8.3
Heavy Equipment Storage	40,800	0.9
Batch Plant/Silos	12,800	0.3
Contractor Storage	64,000	1.5
Fish Passage Facilities	19,200	0.4
Access Roads	146,000	3.4
Sedimentation Basin	174,240	4.0
TOTAL SIZE OF STAGING AREA	817,040	18.8

Source: Bechtel Corporation

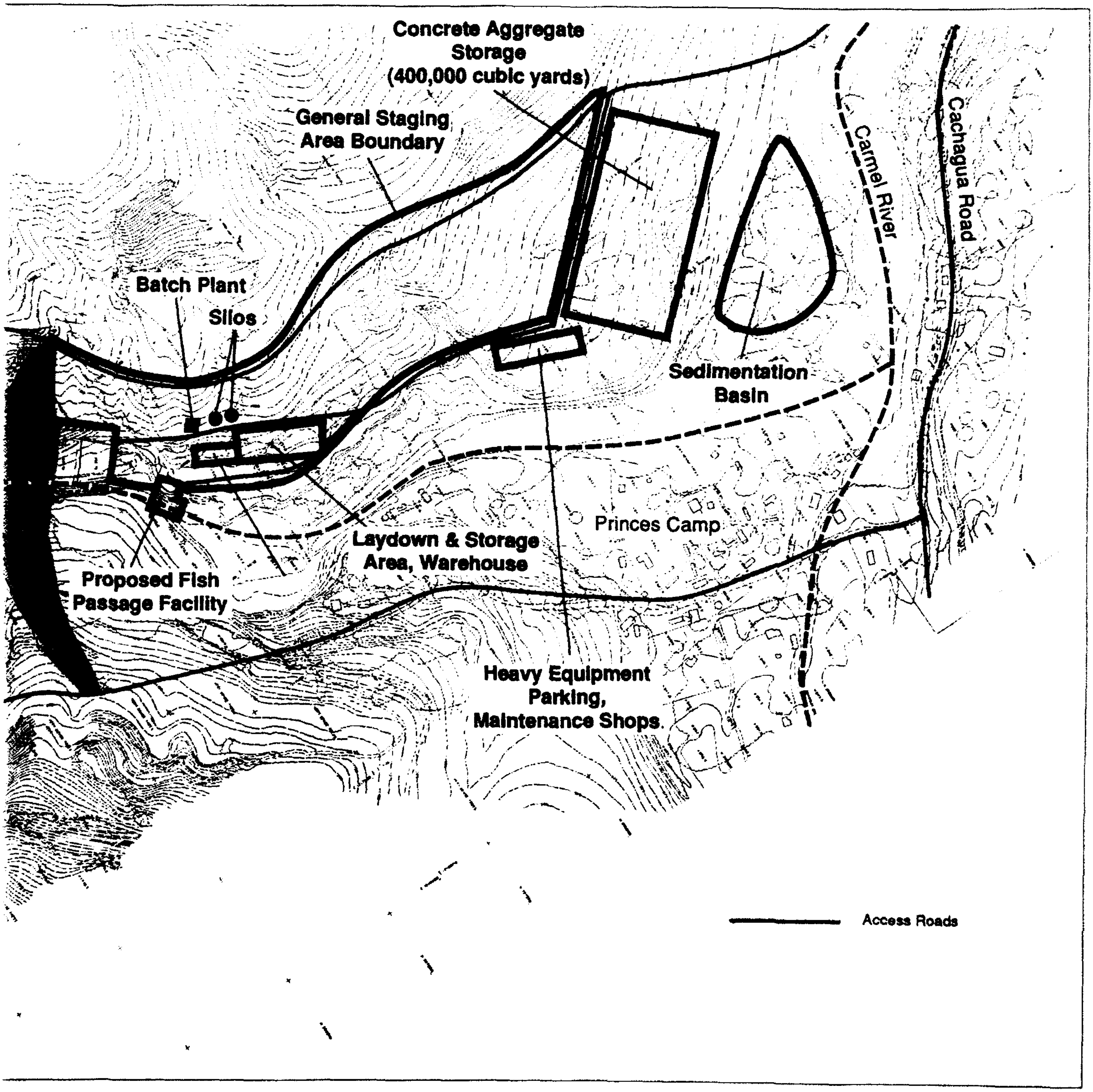
(1)

CONSTRUCTION STAGING AREA FOR THE 24,000 AF
NEW LOS PADRES DAM AND RESERVOIR



(2)

FIGURE 4-5



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The first step in preparing the construction staging area would be the removal of vegetation, removal and storage of the topsoil (for later use in revegetation), and grading of the site. Access road construction would occur at this time, together with construction and grading associated with the sedimentation basins.

A permanent access road would be constructed to the dam crest at the left abutment, which would then continue on along the shoreline of the reservoir to the upstream fish passage facilities, while a second permanent access road would be constructed to the base of the dam and to the fish passage facility (see Figure 4-5).

Sedimentation basins would be constructed to temporarily store stormwater runoff from the construction site and from all areas disturbed during construction. Runoff would be routed to the basin via an interceptor ditch, and stormwater would be stored temporarily to allow the sediment load to settle out prior to release to the Carmel River. A precipitating agent such as alum may be added to enhance the settling of suspended particles, or a package treatment plant may be required. The sedimentation basin would likely cover several acres of land; the exact sizing would be determined during final design.

Aggregate would be quarried from locations upstream of the proposed dam site, mixed to obtain the proper size distribution, and transported (most likely by truck hauling) to the designated aggregate storage area. The aggregate would likely consist of a blend of weathered alluvial material and quarried/crushed rock. Rock quarrying would be accomplished by drilling and blasting within the quarry area; the rock crushing plant would be located upstream of the proposed dam site, near the quarry area. Approximately 50 percent of the aggregate volume necessary for construction would need to be stockpiled prior to the start of dam construction.

Once dam construction began, aggregate would be transported from the storage area to the RCC batch plant, most likely by truck. At the batch plant, the RCC mix would be prepared, consisting of aggregate, cement and pozzolan; once prepared, the RCC mix would then be transported to the dam site by conveyor and spread to form the dam structure. Mixing and pouring of the RCC mix would occur for two ten-hour shifts per day, five days per week, for the 10-month period. Overtime work during weekends could occur, but would be considered unlikely.

Reservoir Clearing and Grubbing

Clearing and grubbing of the reservoir inundation area would occur during the first year of construction. Clearing typically refers to the removal of all standing brush or trees two inches or greater in diameter at a point six inches above the ground, or any vegetation greater than six feet in height. Grubbing refers to the removal of stumps, roots and brush that remain after the clearing operation.

As part of final design the District will develop a detailed Clearing and Grubbing Plan in consultation with responsible and interested agencies. In preparing the Plan, the District will weigh competing concerns expressed by interested parties. For example, Cal-Am and the California Department of Health Services have expressed the need to remove as much vegetation as possible to minimize water quality problems associated with decomposing organic material in the reservoir. Conversely, the California Department of Fish and Game has recommended that vegetation remain in the reservoir in enhance the quality of fish habitat. Other factors include recreational, safety, aesthetic, and Native American concerns.

A Planning Memorandum has been prepared by District staff that addresses the planning, study, and work elements that are typically involved in reservoir clearing and grubbing activities.[5] In the Planning Memorandum, the 24,000 AF New Los Padres Reservoir was used as a representative site to focus the analysis and discussion. This discussion is summarized below and is applicable to the other proposed reservoir sites.

Clearing requirements typically consist of four steps: felling, collection, disposal and clean-up. Clearing would include the removal and proper disposal of all fences; standing and downed trees, alive or dead; log jams; snags; bridges; and all other floatable materials and debris. A variety of heavy duty rakes and plows have been developed for clearing brush, with the heaviest versions utilized for grubbing.

Accessibility of the inundation area for the New Los Padres Reservoir for clearing by heavy equipment would be difficult due to the topography. Slopes vary from zero to 75 percent, with much of the area being greater than 50 percent. Hand clearing with chain saws may be used in the steeper areas in order to control slope stability. It may be necessary to have some upslope operations

working from a "take line" and haul road. Another method of clearing would be to have floating or barge-like collection operations in the existing reservoir.

There exist three basic disposal methods for the vegetation cleared but not useful for lumber or firewood. These materials can be buried, burned, or removed for off-site disposal. Grubbed roots, stumps and other trimmed slash could be buried in pits in the borrow areas or in the excavation area of the dead pool. The main concern would be to prevent reemergence of the buried materials; at least five feet of cover would be necessary. Burning is the most common and most economical means of disposing of the trimmed slash and brush; however, the burning of poison oak would be prohibited. Thus, goats may be used to remove poison oak and other understory vegetation. (See Chapter 11, Climate and Air Quality, for a discussion of the effects of burning.) Riparian trees could be cut and removed for transplanting onto other designated mitigation sites. A portion of the brush and slash debris could be removed to a staging area for chipping. The chipped materials could be used as mulch for revegetation of disturbed areas, donated to regional parks, or sold as biomass for power generation or used as pulp.

Dam Construction

Dam foundation preparation would involve the excavation of the upper 30 to 40 feet of weathered rock to the point where competent unweathered bedrock was encountered. The exposed rock surface would then be treated with high-pressure water jets to improve the binding capacity of the concrete to the rock. Consolidation grouting would then occur by drilling holes along the foundation and injecting a mix of grout and water to provide a more impervious surface and reduce the seepage of water under the foundation, as well as to reduce the hydrostatic uplift forces that could act to destabilize the completed structure. Exploratory drilling at the dam foundation indicates that consolidation grouting would be limited owing to the low fracture permeability of the rock.[6]

Construction of the dam would require a crew of 40 to 125 workers per shift. An average of 20 trucks per day would enter and leave the site by way of Cachagua Road. A list of the on-site construction vehicles and major equipment, with duration of use of each, is provided in Table 4-2.

The Carmel River would be diverted into a 6-foot-diameter conduit on the left side of the river during construction of the dam. A small cofferdam would be constructed upstream of the dam at the intake of the conduit. Flows in excess of the conduit capacity would be spilled over the temporary

TABLE 4-2

CONSTRUCTION EQUIPMENT LIST

Description	Quantity	Number of Months on Project
Dozer - D8-335 Hp	5 3	6 12
Dozer - D6-165 Hp	3	12
Grader 14' Blade 150 Hp	1	18
Dump Truck - 35 T-450 Hp	9 4	6 12
10-Wheel Highway Dump Truck	1	18
Front-End Loader-5 Cy	2	6
Front-End Loader-4 Cy	1	18
Forklift-5,000 Lbs	1	12
Airtrack Drills	5 4	6 12
Compressor - 750 cfm	5	6
Compressor - 375 Cfm	4	12
Compressor - 250 Cfm	1	12
Crane - Hydr.-20 T	4	12
Rotary Drill Rigs for Grouting	4	12
Grout Pump Rigs	2	12
Dewatering Pumps - 4 Inch	2	15
Dewatering Pumps - 2 Inch	2	15
Water Trucks - 4,000 Gal	2	18
Powder Truck - 12 T	1	18
Concrete Mix Truck - 8 Cy	1	12
Flatbed Truck - 12 T	1	20
Pickup Trucks - 0.5 T	12	20
Aggregate Crushing Plant - 100 T/Hr	1	18
Concrete Batch Plant - 100 Cy/Hr	1	18
Concrete Conveyor System - 1,500 Lf	1	12

Source: Bechtel Civil, May 1989.

construction crest of the RCC dam. After completion of construction, the diversion conduit would be plugged with grout.

4.1.3 PROJECT OPERATION

Project operation refers to the manner and timing with which the various components of a project are used to satisfy water demands and to comply with environmental requirements. Specifically, project operation relates to the storage, release, diversion, pumpage, transmission, and treatment of surface and groundwater supplies. Project operation reflects the capacities and configuration of the existing and proposed project components, and includes environmental considerations. In the CVSIM computer simulations, project operation was guided by two concepts: conjunctive use and bypass. Both of these concepts are described below:

Conjunctive Use

All of the project alternatives analyzed in this EIR/EIS were assumed to operate on a conjunctive use basis. Conjunctive use means that the surface water supplies are managed in coordination with groundwater supplies so that the benefit from the total water resource is maximized. By utilizing a conjunctive use approach, it is possible to reduce the size of the necessary surface storage reservoirs and associated treatment facilities and provide a greater measure of system reliability.

Bypass

In addition to utilizing a conjunctive use approach, all of the project alternatives that would either impound (24 NLP, 24 NLP/D) or pump (15 CAN/D) water from the Carmel River mainstem were operated in accordance with the "bypass" logic recommended by the California Department of Fish and Game (CDFG) for evaluating the Cañada Reservoir Project.[7] In their recommendation, CDFG provided a schedule of instream flows that would be required near the Highway 1 Bridge over the Carmel River. These recommended flows are shown in Table 4-3. For each period and portion of the steelhead lifecycle, a flow duration, rate, and volume is given.

In response to a request by Cal-Am for clarification, CDFG stated that any flows over and above the recommended "bypass" flows would be available for diversion.[8] In this context, it is understood that "bypass" flows refer to the flow that is required at an upstream diversion point to satisfy the downstream fishery flow requirement at Highway 1. By definition, bypass flows include sufficient

TABLE 4-3

MINIMUM FISHERY FLOW REQUIRFMENTS AT THE HIGHWAY 1 BRIDGE

Period	Purpose	Duration (Days)	Flow Rate (Cfs)	Volume (AF)
January-March	Attraction	18	200	7,200
	Spawning, incubation and migration	72	40	5,800
April-May	Incubation, migration, and rearing	61	20	2,440
June-December	Rearing	214	5	2,200
	TOTAL	365		17,640

Source: California Department of Fish and Game, 1986.

water to offset any conveyance losses that occur between the upstream diversion and downstream control sites. As an example, if a fishery flow of 5 cfs is required at Highway 1, then a bypass flow of 30 cfs may be required at the upstream diversion site. The difference between the bypass and fishery flows, 25 cfs, would be needed to ensure that a minimum of 5 cfs reaches Highway 1. The 25 cfs would recharge the depleted aquifer and replace any channel losses, ground water losses due to pumping, and evapotranspiration by riparian vegetation. This recharge rate would decrease over time as the aquifer became fully recharged, and would eventually equilibrate to the daily loss rate.

Under the recommended bypass operation, any flow in the Carmel River in excess of the bypass requirement at that location could be diverted or stored. That is, if the inflow is greater than the bypass flow, the excess could be diverted or stored, depending on available storage and pumping capacity. Conversely, if the inflow at the diversion site is less than the bypass flow, all of the inflow would be bypassed and no diversion or storage would be allowed. For example, if the bypass requirement was 30 cfs and the inflow was 75 cfs, then 30 cfs would be bypassed and 45 cfs could be

diverted or stored. However, if the inflow was 20 cfs, then the entire 20 cfs would be bypassed and no flow would be diverted or stored.

CDFG proposed the bypass logic as an alternative operation plan in an effort to minimize active reservoir management and dependence upon humans for upstream and downstream migration flows.[9] Conceptually, the bypass logic was designed to reflect and mimic natural conditions to the degree possible. The District adapted this bypass logic to all project alternatives that would impound or pump excess flow from the Carmel River mainstem to new storage facilities. The District incorporated the bypass logic in its project operation to comply with CDFG recommendations, and to provide a common basis for comparing project performance and environmental impacts.

In adapting and analyzing the bypass logic, the District introduced three modifications to the flow schedule recommended by CDFG for use in the 1991 SD EIR/EIS:

1. January - March Migration Flows. The 40 cfs flow at Highway 1 during the January - March period was increased to 75 cfs. This change was based on a review of all available information by District staff, which indicated that a transportation flow of 40 cfs would delay and impede the upstream migration of adult steelhead and would not provide sufficient adult holding habitat.[10]

   For the analyses in this EIR/EIS, it was agreed that the 75 cfs flow would be used. This value would be re-evaluated as part of a critical riffle study which would be conducted when sufficient flow and steelhead returned to the Lower Carmel River.

2. January - March Attraction Flows. The 75 cfs flow at Highway 1 during the January - March period was decreased to 5 cfs until an attraction event had occurred. This change was made based on the logic that the 75 cfs flow for adult migration and holding habitat would not be required until after the adults had been attracted and had entered the river from the ocean. Therefore, until a 200-cfs event occurred during the January - March period, the fishery flow requirement would be maintained at the June - December level of 5 cfs.

3. Flow Augmentation. For all of the upstream storage projects that would store or divert excess Carmel River flows (i.e., 24 NLP and 24 NLP/D), bypass releases would be augmented with stored water. This change was made to balance surface and groundwater storage, and to minimize the conveyance losses associated with the bypass flows. Specifically, if the inflow at the diversion site is insufficient to satisfy the downstream flow requirement, stored water would be added to the release to compensate for the conveyance losses and to augment the fishery flow. For example, if the bypass requirement at New Los Padres was 30 cfs and the inflow was 20 cfs, then 20 cfs would be bypassed and 10 cfs from storage would be released to provide the minimum recommended flow at Highway 1 (i.e., 5 cfs). The primary purpose for releasing stored water from the upstream reservoirs would be to maintain groundwater levels in Carmel Valley. A secondary, incidental benefit would be that the recommended flows would occur more frequently at Highway 1 during dry periods when the Lower Carmel

Valley aquifer subunits were depleted. The periods when bypass flows would be augmented varied with reservoir size and location, and are described in the descriptions of project operations for the pertinent alternatives.

Each of these modifications was discussed with CDFG staff and was given conditional approval.[11]

It should also be noted that any combination of 18 days with flows of 200 cfs or greater at Highway 1 is considered by CDFG to be sufficient for adult attraction during the January - March period.[12] Once a 200 cfs event at Highway 1 has occurred, the required fishery flow can be either 200 cfs or 75 cfs. It is not necessary to have either (1) a total of 18 days or (2) 18 continuous days of 200 cfs before using the 75 cfs requirement as the basis for estimating bypass requirements. The specific fishery flow requirement for any day will depend on the magnitude of the upstream inflow and the conveyance losses expected between the upstream diversion site and Highway 1. In the CVSIM simulations, Carmel River flow at the Lagoon was used to approximate Carmel River flow at Highway 1.

Modifications to the Bypass Operations for the 1993 SD EIR/EIS-II

Because of concerns expressed by several commentors regarding the flows provided by the 24 NLP Project for adult, upstream migration during the January-March period, several revisions to the proposed operations were considered by the District. In order to develop a consensus on the technical fishery-related issues, a Fishery Working Group (FWG) was formed with the state and federal reviewing agencies. This group met four times between February and July 1992 to resolve operational issues.[13] Key elements from these meetings are summarized below.

As discussed above, the original focus of the modifications was to improve adult steelhead attraction opportunities while maintaining the shape of the unimpaired hydrograph at the Lagoon as closely as possible. During the FWG meetings, this focus was expanded to include all periods and phases of the steelhead lifecycle, dry-year flow criteria, and other project alternatives. This expanded focus was necessary because of the tradeoffs involved. These tradeoffs are based on the fact that any water released in the January-March period for adult attraction and migration will not be available for release in the April-May period for smolt emigration or in the June-December period for juvenile rearing.

In most years, there will be sufficient storage and inflow to provide the specified flows throughout the year. However, in consecutive dry or critically-dry years when inflow is minimal and storage is depleted, large winter releases will impact the ability of the NLP Projects to maintain spring, summer, and fall flows into the Lagoon. The expanded focus is consistent with CDFG's recommendation that dry year criteria be developed to supplement the Department's minimum flow requirements criteria that were submitted to the District in 1986.[14] To address these tradeoffs, four additional modifications were developed and endorsed by the FWG for use in the 1993 SD EIR/EIS-II:

(1) Use District's water supply index as the basis for determining releases for varying water supply conditions (e.g. sliding scale).

(2) Utilize "sliding scale" to increase flow requirements during normal or better and below normal periods or reduce requirements during dry or critically-dry periods.

(3) Use multiple control points -- Lagoon, Narrows, and below New Los Padres Dam -- to insure that sufficient fishery flows are maintained in all reaches of the river.

(4) Include estimates of downstream tributary inflows in the projected flow at the Lagoon.

The District's "water supply" index refers to a classification system in which the inflow conditions in the Carmel River are quantified and assessed during the current water. The index, which is termed STATUS in the CVSIM model, is based on cumulative and expected unimpaired inflows at San Clemente Dam and is updated at the beginning of each month. Given cumulative inflows to date, estimates of the minimum flow expected for the remainder of the water year are made for each water year class. The estimates of expected inflows are specified at the 75 percent reliability level. The expected inflows are used in conjunction with the cumulative inflows to classify water year type (i.e., normal or better, below normal, dry, or critically-dry) expected for the entire water year. Additional discussion of the derivation of the water supply index is provided in Appendix 5, CVSIM Overview.

The District's water supply index was developed as a decision-making tool and is similar to the indices developed by the California Department of Water Resources for the San Joaquin and Sacramento River Basins. The use of these indices for decision-making is based on the premise that different requirements are appropriate for different water year types.

Another modification that was discussed by the FWG, but was not resolved, involved the use of reservoir storage as a trigger for reduced flow requirements. Specifically, whenever simulated usable

storage in NLP Reservoir fell below 2,000 acre-feet, reservoir operations would revert to No Project conditions. This mode of operation would continue until usable storage in NLP Reservoir reached 7,500 acre-feet. Under this "revert" operation, a minimum release of 5 cfs below NLP and San Clemente Dams is required at all times; no flow requirements are specified downstream of the Sleepy Hollow Weir.

A similar modification entailed the use of reservoir storage values in conjunction with the water supply index as a trigger to reduce flows at the Lagoon in the April-May and June-December periods. Both of these modifications were incorporated into CVSIM for the SD EIR/EIS-II simulations.

The proposed flow schedule for the New Los Padres Project that was developed by the FWG is shown in Table 4-4. This schedule summarizes the decision criteria that will be used to operate the NLP Projects to satisfy the instream flow needs of the steelhead fishery in the Carmel River. The flows shown on the schedule represent target flows; actual flows will depend on available inflow and storage. Because of the uncertainty inherent in future inflows, there is no guarantee that these flows can be maintained in all years. The minimum releases from NLP Reservoir will, however, in all cases equal or exceed the natural inflow to the reservoir.

To quantify the frequency that the recommended flows cannot be met, the FWG has proposed that a "performance analysis" be conducted. Based on preliminary results from the performance analysis, the daily flow requirements shown in Table 4-4 would be met or exceeded 87 percent of the days during the simulated 90-year period. The periods when the recommended flows cannot be met coincide with extended dry periods (e.g. 1930-1934, 1961-1962, 1977-1978, and 1988-1991) when reservoir storage is depleted. If the 24 NLP Project is combined with a 3 MGD Desalination Plant, the daily flow requirements would be met or exceeded 90 percent of the days that were simulated.

In Table 4-4, the phases of the steelhead lifecycle are grouped into three periods which run across the table. Similarly, the different water year conditions are divided into four classes which run down the table. By specifying the month, the water year class, and, in some cases, reservoir storage, the downstream flow requirements at either the Narrows or the Lagoon can be determined. For example, in May of a normal or better year, 40 cfs would be provided to the Lagoon. If it was May of a

TABLE 4-4

PROPOSED FLOW SCHEDULE FOR NEW LOS PADRES PROJECT

JANUARY-MARCH	APRIL-MAY	JUNE-DECEMBER
Normal or Better Years	**Normal or Better Years**	**Normal or Better Years**
Maintain 5 cfs to the Lagoon for juvenile rearing until an attraction event is projected. Whenever an attraction event is projected, maintain 200 cfs to the Lagoon for the duration of the attraction event. Following an attraction event, provide migration flows of 200 to 60 cfs to the Lagoon, depending on estimated natural recession rates. Following the migration period, maintain 40 cfs to the Lagoon and 70 cfs at the Narrows for spawning.	Maintain 40 cfs to the Lagoon for smolt emigration.	Maintain 5 cfs to the Lagoon for juvenile rearing.
Below Normal Years	**Below Normal Years**	**Below Normal Years**
Same flow requirements as Normal or Better Years.	Same flow requirements as Normal or Better Years except that if reservoir storage is less than 10,000 AF, maintain 30 cfs to the Lagoon for smolt emigration.	Same flow requirements as Normal or Better Years.
Dry Years	**Dry Years**	**Dry Years**
Same flow requirements as Normal or Better Years except that: (1) If reservoir storage is less than 7,500 AF, maintain 20 cfs at the Narrows for juvenile rearing. No flow is required at the Lagoon. (2) Whenever an attraction event is projected, maintain either 200 cfs in January, 100 cfs in February, or 75 cfs in March to the Lagoon for the duration of the attraction event. (3) Following the migration period, maintain 40 cfs to the Lagoon and 50 cfs at the Narrows for spawning.	If reservoir storage is greater than 10,000 AF, maintain 30 cfs to the Lagoon for smolt emigration. If reservoir storage is less than 10,000 AF, maintain 20 cfs to the Lagoon for smolt emigration.	Same flow requirements as Normal or Better Years except that if reservoir storage is less than 7,500 AF, maintain 20 cfs at the Narrows for juvenile rearing. No flow is required at the Lagoon.
Critically-Dry Years	**Critically-Dry Years**	**Critically-Dry Years**
Same flow requirements as Normal or Better Years except that: (1) Maintain 10 cfs at the Narrows for juvenile rearing. No flow is required at the Lagoon. (2) Whenever an attraction event is projected, maintain either 200 cfs in January, 100 cfs in February, or 75 cfs in March to the Lagoon for the duration of the attraction event. (3) Following the migration period, maintain 20 cfs to the Lagoon and 30 cfs at the Narrows for spawning.	Maintain 20 cfs to the Lagoon for smolt emigration.	Maintain 10 cfs at the Narrows for juvenile rearing. No flow is required at the Lagoon.

Note: Whenever usable storage in New Los Padres Reservoir falls below 2,000 acre-feet, reservoir operations and associated instream flow releases and requirements "revert" to No Project conditions. This mode of operation continues until usable storage in New Los Padres Reservoir exceeds 7,500 acre-feet.

Source: MPWMD

critically-dry year, the requirement would be reduced and 20 cfs would be provided to the Lagoon. In some instances, such as June of a dry year with reservoir storage less than 7,500 acre-feet, no flow is required at the Lagoon and 20 cfs would be provided to the Narrows.

As indicated in Table 4-4, the most complicated operations occur in the January-March period when decisions regarding releases for adult attraction, migration, and spawning must be made. The key decision element is defining when a attraction event will begin and when it will end. For normal or better or below normal years, an attraction event occurs when -- based on inflow to NLP Reservoir, downstream tributary inflows, and all expected conveyance losses between NLP Reservoir and the Lagoon -- it is projected that 200 or more cfs will reach the Lagoon. The attraction event is continued as long as the projected flow at the Lagoon exceeds 200 cfs. The attraction event is ended when the projected flow at the Lagoon is less than 200 cfs.

Following the attraction event, migration flows from 200 to 60 cfs are provided to the Lagoon. This decrease in flow is based on natural recession rates. Once the projected flows at the Lagoon drop below 60 cfs, the migration period is ended and flows for spawning are provided at the Narrows and the Lagoon. These flows, 70 and 40 cfs at the Narrows and Lagoon, respectively, are maintained for the remainder of January-March period. These criteria for defining an adult attraction event and related migration and spawning periods are illustrated in Figure 4-6.

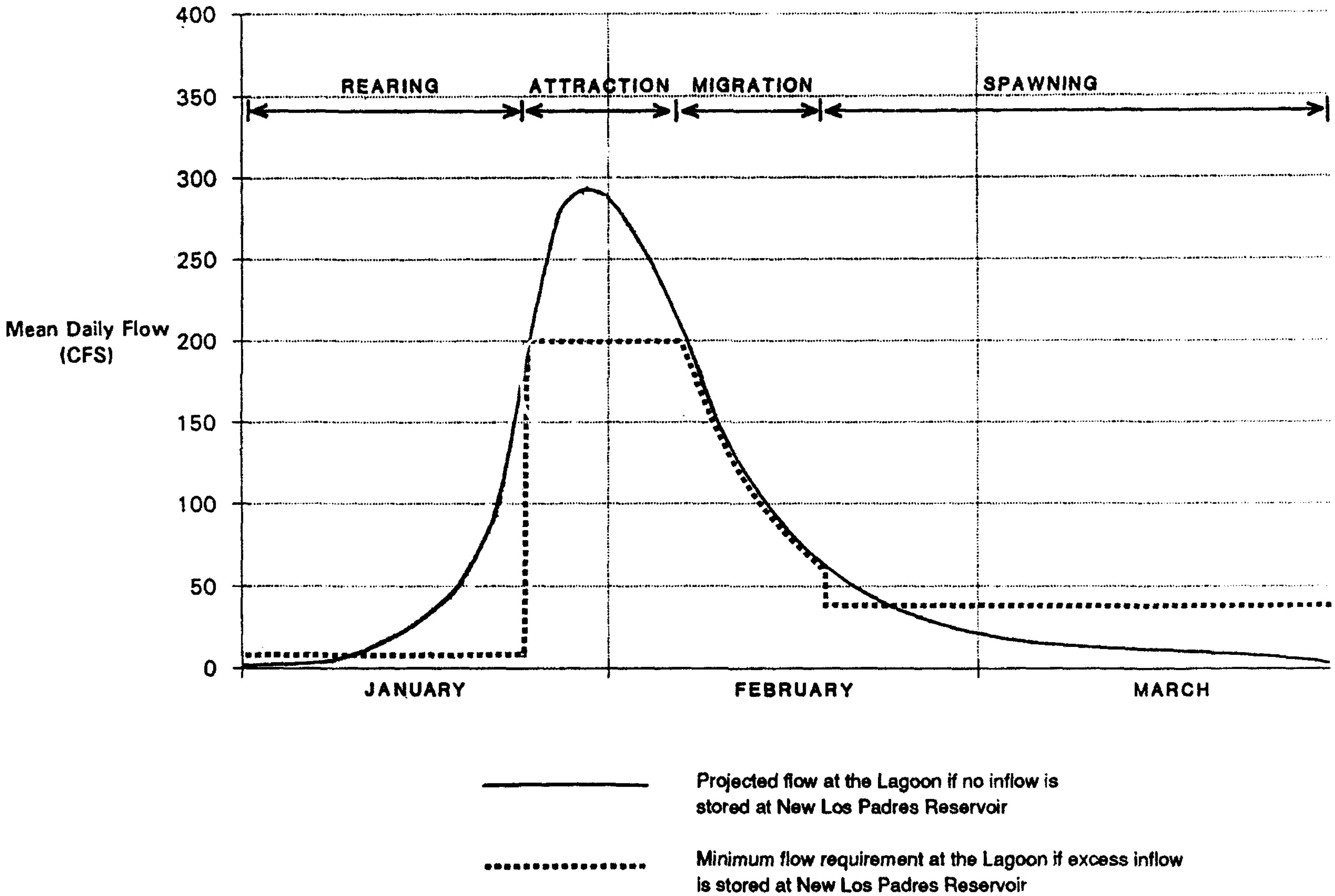
The solid line in Figure 4-6 represents projected flow at the Lagoon, assuming that no inflow at NLP Reservoir is stored. The dashed line represents the minimum flows that would occur at the Lagoon, assuming that all excess inflow at NLP Reservoir could be stored. In many cases, NLP Reservoir will be full and the entire projected flow will occur at the Lagoon. It should also be noted that Figure 4-6 is simplified and, in reality, could have multiple attraction events superimposed on each other.

Table 4-5 summarizes the volume of flow at the lagoon that would be required monthly with the proposed flow schedule shown in Table 4-4. Actual requirements will vary daily depending on natural inflow and available reservoir storage. Annual flow requirements would range from 3,370 AF/yr in critically dry years to 23,360 AF/yr in normal years.

The same flow schedule that was proposed for the NLP Projects was used for 15 CAN/D Project simulation with two exceptions. First, the 15 CAN/D project did not include any provision for the

CRITERIA FOR DEFINING ADULT ATTRACTION EVENT AND RELATED MIGRATION AND SPAWNING PERIODS FOR THE CARMEL RIVER STEELHEAD FISHERY

FIGURE 4-6



SOURCE: MPWMD

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TABLE 4-5

24,000 ACRE-FOOT NEW LOS PADRES RESERVOIR PROJECT
PROPOSED INSTREAM FLOW REQUIREMENTS
AT THE CARMEL RIVER LAGOON
(All Values in Acre-Feet)

	Water Year Type		
Month	Normal	Dry	Critical
January	2,490	10	0
February	6,010	2,140	280
March	7,880	2,460	670
April	2,380	1,790	1,190
May	2,460	1,840	1,230
June	300	300	0
July	310	310	0
August	310	310	0
September	300	300	0
October	310	0	0
November	300	0	0
December	310	0	0
TOTAL	23,360	9,760	3,370

Note: The requirements shown are representative monthly volumes. Actual requirements will vary daily depending on natural inflow and available reservoir storage. In addition, instream flow requirements have been specified for below New Los Padres Dam and at the Narrows.

One acre-foot is equivalent to approximately 0.5 cubic feet per second, sustained for 24 hours.

Source: MPWMD

release of stored water to augment instream flows. Second, the projected flows at the Lagoon for the 15 CAN/D Project were based on inflows at the Narrows and at the Near Carmel sites, rather than inflows to NLP Reservoir. Because the 15 CAN/D Project would divert flows farther downstream than the NLP Projects, the projected flows for the 15 CAN/D Project would be less reliant on estimated inflows and conveyance losses. For both the 15 CAN/D and NLP Projects, the maximum number of days specified for adult attraction would be limited only by natural inflow conditions during the January-March period.

Basic Operations

Operational plans were developed and incorporated into CVSIM for each alternative. The plans focused on the operation of the Cal-Am system and were designed to meet the water supply goals of the District. The plans reflect District policy and are consistent with present and projected Cal-Am production facilities. All operational decisions were structured in a real-time context and are based solely on information that would be available to system operators.

The operational plans were designed to cover a range of conditions and to provide a common basis for comparing project performance and associated environmental impacts. The primary differences among the operations relate to the level of instream flows provided by each project alternative. This level is a function of the storage provided by each project and is described below in the specific operations for each alternative.

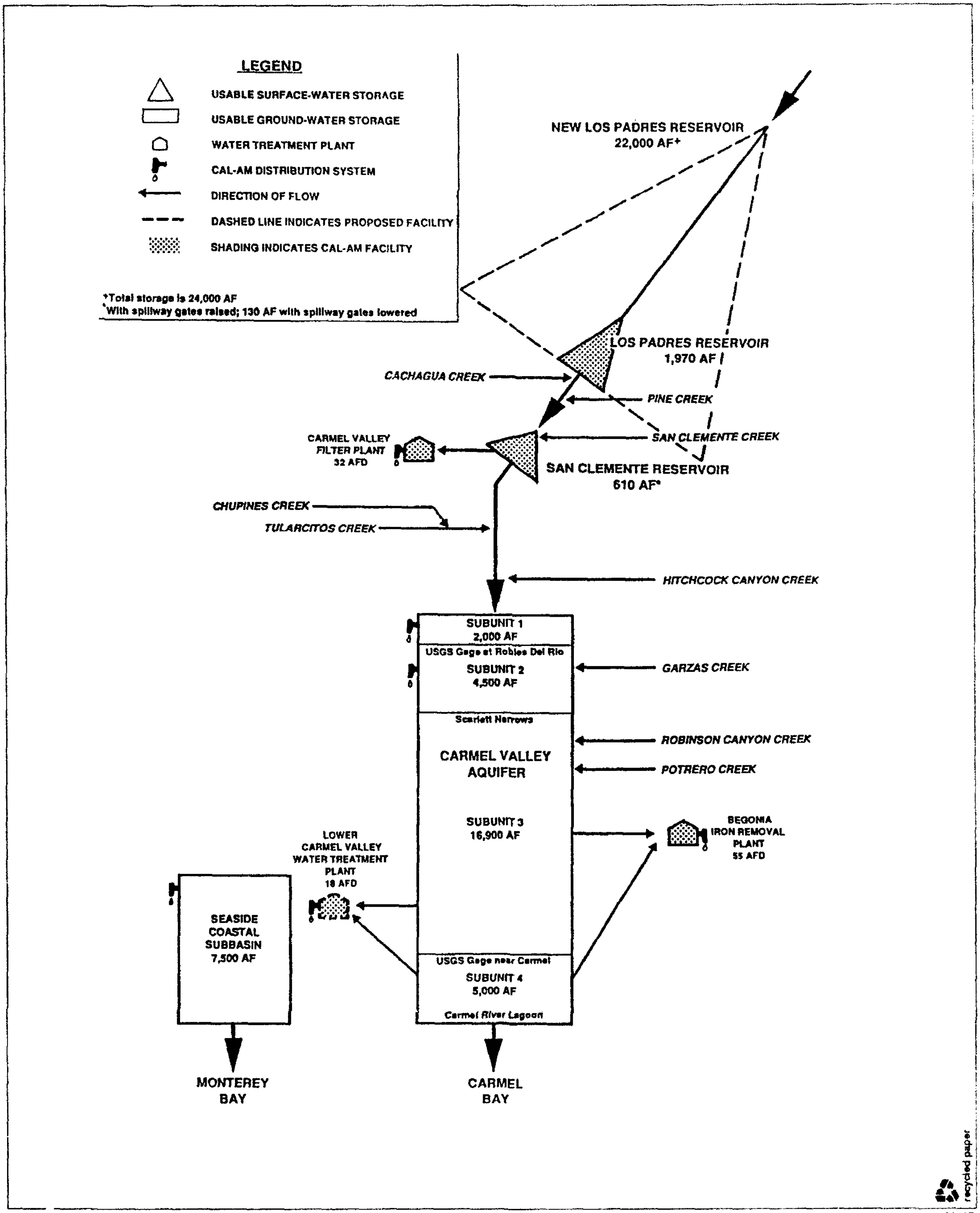
Specific Operations for 24 NLP

In the CVSIM simulation, operational decisions are made at the beginning of each month and updated daily depending on inflow, storage, demand, and pumping conditions. The decisions are made in a downstream, sequential order. For simulation purposes, the production sequence for Cal-Am's facilities begins in the Seaside Coastal Basin and then moves through the Carmel River system (Figure 4-7). Each day, a recursive routine is used to satisfy Cal-Am demand and instream flow requirements. A maximum of 50 iterations are made each day. Decisions regarding specific production sources are presented below.

Seaside Coastal Basin. At the beginning of each month, a target value for Cal-Am's production wells in Seaside Coastal Basin (SCB) is set. The target ranges from approximately 100 to 800 acre-feet per

OPERATIONAL SCHEMATIC FOR 24,000 AF NEW LOS PADRES RESERVOIR

FIGURE 4-7



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SOURCE: MPWMD

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month and varies according to Cal-Am's expected monthly demand and projected water supply conditions. During low demand periods or normal and wet years, the monthly target is reduced accordingly. However, if a shortage occurs in the Cal-Am system after the first iteration, production from SCB is increased to offset or reduce the deficit. Under both Project and No Project conditions, maximum production from Cal-Am's wells in the SCB is 19.9 acre-feet per day. This production includes the pumping capacity from Cal-Am's existing eight wells in the Seaside area plus the projected capacity for Cal-Am's Paralta Well in the Fort Ord Coastal Subbasin. Development of the Paralta Well will add 2,800 AF of usable storage to the Seaside Coastal Subbasins for a total of 7,500 AF.

Carmel Valley Filter Plant. In the CVSIM simulations, it is assumed that the Carmel Valley Filter Plant (CVFP) is supplied exclusively from diversions from San Clemente Reservoir. Maximum capacity at the CVFP is 32 acre-feet per day. For the simulations, the minimum capacity at the CVFP was assumed to be 7 acre-feet per day, and is necessary to provide adequate service to the Carmel Valley Village area in the Upper Carmel Valley.[15] At the beginning of each month, a daily target value for Cal-Am's CVFP is set according to projected water supply conditions. During dry and critically dry years, production from the CVFP was set at the minimum. If there is sufficient carry-over storage in the surface water reservoirs, maximum production from the CVFP is allowed during dry periods. For this EIR/EIS, 15,000 acre-feet of usable reservoir storage was considered sufficient to allow maximum CVFP production. Daily production from the CVFP was set on the first iteration and was not changed during subsequent iterations.

Upper Carmel Valley Wells. Under existing conditions, the District discourages production from Cal-Am's wells in the Upper Carmel Valley Aquifer subunits (UCV). By limiting Cal-Am pumpage in the UCV to maintenance levels (20 acre-feet per month), flow releases from San Clemente Reservoir are sufficient to maintain minimal fishery and riparian habitat through most of the UCV. Under Project conditions, Cal-Am production from UCV wells would be limited to maintenance levels except during critically dry periods. The usable storage in the UCV (6,500 acre-feet) would be used only when production from all other Cal-Am sources of supply is insufficient to satisfy the specified daily demand. Specifically, monthly production from the wells in subunits 1 and 2 would be limited to maintenance levels. For this EIR/EIS, it was assumed that maintenance pumping would equal the maximum production rate from each subunit for one day each month; i.e., 2.6 and 12.3 acre-feet for subunits 1 and 2, respectively. During critically dry periods, production from subunit 2 would be

increased to offset shortages on the fourth iteration and, if needed, production from subunit 1 would be increased on the fifth iteration.

Lower Carmel Valley Wells. Under existing conditions, production from Cal-Am's wells in the Lower Carmel Valley Aquifer subunits (LCV) accounts for approximately 9,000 acre-feet or 53 percent of total annual production. Under Project conditions, Cal-Am's wells in the LCV would be increased to over 10,000 acre-feet per year. This increased production from LCV would be possible because of the additional storage that would be available due to the release of stored water from New Los Padres Reservoir in the summer and fall months. In the CVSIM simulations for the No Project and 7 DSL alternatives, production from Cal-Am's wells in the LCV is maximized on the first iteration to satisfy any Cal-Am demand that exceeds the combined production from the SCB, CVFP and proposed desalination facility, when applicable.

In the CVSIM simulations for the 24 NLP, 24 NLP/D, and 15 CAN/D conditions, it is assumed that Cal-Am will replace three of their production wells in subunit 3 of the LCV – Cypress, Pearce, and San Carlos wells – and develop a new well in subunit 4 of the LCV. The exact location of the new well in subunit 4 is not known at this time, but exploratory work is planned for the Val Verde - Rio Road area. The replacement wells in subunit 3 would increase production capacity by approximately 20 acre-feet per day and the new well in subunit 4 would increase production capacity by 8.8 acre-feet per day. The replacement wells and the new well would be developed to insure sufficient production capacity to meet the estimated maximum day demand under buildout conditions.

In the CVSIM simulations for the NLP and CAN Reservoir Projects, it was assumed that, under normal conditions, only one of the wells in subunit 4 would be operated at one time. Both wells would be operated only during periods when production from all of Cal-Am's other production wells in the LCV is maximized and demand exceeds supply.

Cal-Am production in the LCV is distributed among the wells in subunits 3 and 4 based on available usable storage and pumping capacities. In the simulations, Cal-Am's production wells in the LCV were operated in an upstream order. That is, based on the estimated daily Cal-Am demand, production is maximized first in subunit 4 and then in subunit 3, as needed. This type of operation is designed to both minimize and localize the river reaches that would be dewatered during an extended dry period. For the CVSIM simulations, maximum daily production rates of 77.5 and 17.7

acre-feet were specified for subunits 3 and 4, respectively. The total production from Cal-Am's wells in the LCV is currently constrained by the capacity at the Begonia Water Treatment Plant, which is rated at 55.3 acre-feet per day.

Reservoir Operations. The 24,000 AF New Los Padres Reservoir would be operated in conjunction with the existing San Clemente Reservoir based on the conjunctive-use and bypass concepts described above. All operational decisions regarding bypass, storage, and release volumes would be governed by the "bypass rule," as modified by the interagency Fisheries Working Group. During high-flow periods, when inflow is greater than bypass requirements at New Los Padres Dam, excess flows would be stored for later use. During low-flow periods, when inflow is less than the bypass requirement, no flows would be stored and all of the inflow would be bypassed through the reservoir. In addition, if the inflow is insufficient to satisfy the fishery flow requirement at the Carmel River Lagoon because of conveyance losses, additional releases of stored water would be made. These additional releases would be made to recharge ground water storage, minimize conveyance losses, and ensure that the recommended flow requirement at the Lagoon is satisfied as often as possible. Depending on available storage, these additional releases would be provided year-round with the 24 NLP alternative.

Demand Management. During droughts and other water supply emergencies, it is sometimes necessary to reduce water demand to bring existing supplies and demand into balance. This imbalance can be caused by a lack of supply, by the inability to treat and deliver water at the rate demanded, or a combination of these factors. In the simulations, water demand was reduced by imposing water rationing during anticipated and actual water shortages. The rationing logic in CVSIM relies solely on information that would be available in real-time and is designed to forestall or lessen the impacts from severe or sustained droughts. In this sense, the rationing logic results in "managed" shortages.

In the simulations, rationing requirements were determined monthly based on a comparison of expected system demand and supply. Expected demand included Cal-Am water demand, assuming dry conditions, for the remainder of the current water year plus a selected target volume of water that would be available at the start of the following water year. Expected supply included current usable reservoir and aquifer storage plus surface inflow expected in the Upper Carmel River Watershed during the current water year. The target volumes were used to trigger increased levels of water rationing. Three target volumes were specified in the simulations and are shown in Table 4-6. In

TABLE 4-6

WATER RATIONING PARAMETERS UNDER BUILDOUT CONDITIONS

Phase	Water Availability Risk	Demand Reduction(%)	Target Volume[1] (Acre-Feet)
1	None	0	> 17,900
2	Low	10	17,900 - 14,900
3	Medium	15	14,900 - 11,900
4	High	25	< 11,900

[1] Based on specified percentages – 75%, 62.5%, and 50% – of Cal-Am annual demand under dry conditions (i.e., 23,888 acre-feet).

Source: MPWMD

the simulations, these volumes were expressed as percentages of Cal-Am dry-year demand and are equivalent to the acre-foot volumes shown in Table 4-6. These target volumes defined four levels of water reductions: 0, 10, 15, and 25 percent. The expected inflows were based on conditional probabilities derived from the long-term flow record at San Clemente Dam. These inflows were specified at the 75 percent reliability level, which means that the projected inflow will be equalled or exceeded in three out of four cases. The estimate of expected inflow is updated at the beginning of each month.

The target volumes that were used in the simulations were developed by trial and error using CVSIM for the entire period of record. The volumes were selected to provide an early and orderly response to potential and real water shortages. In general, it was assumed that an early, low-level response would be preferable to a deferred, high-level response.

It should be noted that the project operations developed for the CVSIM analyses were not designed to "optimize" the performance of each individual alternative. Instead, the operations for all the alternatives were designed and kept as similar as possible in order to provide unbiased, relative measures of project performance and associated environmental impacts.

4.1.4 WATER SUPPLY PHASING AND YIELD

All long-term water supply alternatives, including the 24,000 AF New Los Padres project, are sized to meet annual demand at buildout (see Chapter 2). Total demand at buildout would include an estimated 22,750 AF of Cal-Am production in a normal year and nearly 3,300 AF for non-Cal-Am production in the Monterey Peninsula Water Resources System. Allocation of project water for new connections would be phased in five-year increments to facilitate orderly development, as defined by, and in compliance with the 1991 Air Quality Management Plan (or subsequent Plans) prepared by the Monterey Bay Unified Air Pollution Control District. It is estimated that new demand would occur at an average rate of about 160 AF per year Cal-Am production.

In nearly all water years, the 24 NLP alternative would meet the 22,750 AF normal year buildout demand. However, in a severe drought year such as 1990, the simulated firm yield would be 18,320 AF, or about 77 percent of the buildout demand expected in that year (about 23,890 AF). "Firm yield" refers to the Cal-Am yield in the "worst year," when the project performs most poorly in terms

of meeting municipal demand. It should be noted that firm yield does not include instream benefits or supply for non Cal-Am production. Please see Chapter 5 for more information.

At the assumed buildout demand level of 22,750 AF Cal-Am production, yield from the 24 NLP alternative in water year 1990 would fall short of the District's goal of achieving 90 percent of Cal-Am demand in all water years. The 24 NLP would fail to meet this goal in three additional drought years in the 90-year simulated record. In order to attain the "90 percent goal" in severe droughts, Cal-Am production would need to be reduced to about 20,500 AF annually. Thus, as shown in Table 4-7, the 24 NLP alternative alone could support about 20 years of growth, assuming a growth rate of 160 AF/year of new production beginning with a base Cal-Am demand of 17,359 AF production.

4.1.5 PROJECT TIMELINE

For the purposes of cost estimates, this EIR/EIS assumes that the first year of operation for the 24 NLP alternative would be the year 2002, with the midpoint of construction in the year 2000. Assuming an optimistic timeline and no unanticipated delays, the project could be on line as early as 1999. This assumes a successful authorizing election in late 1994, final design completion by late 1996, construction completed by Fall 1998 and reservoir filling by Spring 1999.

4.2 24,000 AF NEW LOS PADRES RESERVOIR WITH 3 MGD DESALINATION PLANT (24 NLP/D)

The 24,000 AF New Los Padres Dam and Reservoir combined with a 3 MGD desalination plant was selected for analysis due to the concern that a 24,000 AF New Los Padres Reservoir alone would not be able to provide sufficient instream releases and municipal water supply in an extended (four years or more) severe drought at buildout demand levels. The 24,000 AF New Los Padres Dam and Reservoir is discussed in Section 4.1; therefore this section will only address the 3 MGD desalination plant, located in Sand City. Please refer to Section 4.2.10 for information on timelines for project components.

A Desalination Feasibility Study completed in July of 1991 evaluated seven alternative desalination plant sites and treatment options.[16] The District selected three sites for further evaluation during preliminary design: the Pacific Gas and Electric (PG&E) power generation plant at Moss Landing

TABLE 4-7

YEARS OF GROWTH PROVIDED BY LONG-TERM WATER SUPPLY ALTERNATIVES[1]

Alternative	Number of Years
24 NLP	20
24 NLP/D	34
15 CAN/D	27
7 DSL	34

[1] Assumes growth rate of 160 AF/year of new production beginning with a base demand of 17,359 AF annual Cal-Am production. The 34 years is based on an assumed demand of 22,750 AF Cal-Am production at buildout.

Source: MPWMD

(MLPP), the Monterey Regional Water Pollution Control Agency (MRWPCA) wastewater treatment plant northeast of Marina, and a site in Sand City. The three project alternatives are described in the report, *Desalination Preliminary Design Final Report* (March 1992), prepared by James M. Montgomery Engineers.[17] After completion of the Near-Term Desalination Project Draft EIR on these three alternatives in April 1992, the MPWMD selected the Sand City site as the preferred location for a 3 MGD project. The Final EIR was certified in January 1993.[18]

Based on the findings of the Feasibility Study, reverse osmosis (RO) was the treatment process selected for desalinating the seawater. In the RO process, high-pressure feed pumps are used to pass water through semipermeable membranes. The membranes reject most of the salt ions in the feed water, resulting in a product water with a low salt content. Product water would be conveyed to the Cal-Am distribution system through pipelines from the Sand City desalination plant site. The reject water (brine) would be discharged back to the ocean via injection below the surf zone.

Based on current system operation, the Cal-Am water distribution system could only receive flows from the desalination plant during the 15 hours of highest system demand in each day. Therefore, the desalination project would require a facility in which to store water produced during the nine-hour period when Cal-Am could not receive the water. For the Sand City site, only one alternative for pumping and storage is viable, with a single pumping station located at a nearby storage tank to lift the water from the tank to Cal-Am's system pressure. It should be noted that the storage requirements currently identified may be reduced or eliminated as a result of more detailed operations analyses during the Final Design stage.

An existing warehouse located at the corner of Catalina Street and Elder Avenue in Sand City has been identified as the preferred site for construction of a 3 MGD desalination facility. This site lies entirely within District boundaries. The plant would utilize radial wells for the seawater supply, thereby minimizing pretreatment requirements. A seawater pipeline would convey raw seawater to the desalination plant, and an RO process would be used to desalinate the seawater. Posttreatment for corrosion control would consist of either chemical additions or blending with well water in the treated water storage tank. A connection to the Cal-Am water distribution system would be made in Sand City, about three blocks away from the desalination plant. The brine stream would be injected into the beach sands north of Sand City, for ultimate discharge to Monterey Bay. The project elements are presented in Figures 4-8 and 4-9. Each of these components is described below in further detail.

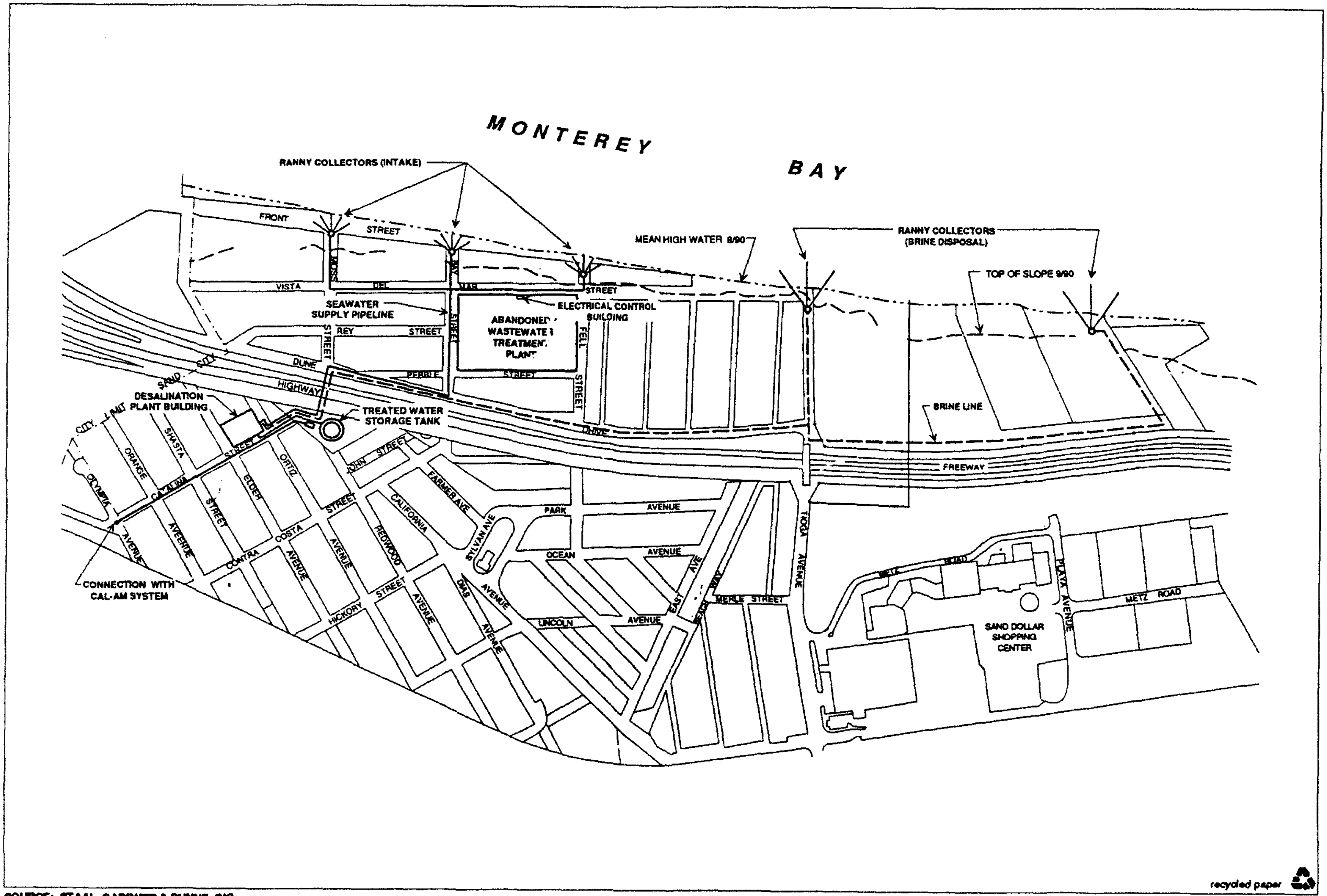
4.2.1 SEAWATER INTAKE

Three radial wells (Ranney collectors)[19] are proposed for this alternative to provide the raw seawater. A Ranney collector is a radial well consisting of a vertical caisson extending below the water table from which horizontally placed perforated screens are extended. The Ranney collectors would be located approximately 100 feet inland from the mean high tide line within the beach area. Figure 4-10 depicts a typical Ranney collector used as a seawater intake structure.

The proposed collectors would be covered within beach or dune sands. Therefore, permanent aboveground structures would be limited to an electrical control building located at a distance from the collectors. The permanent land take would be limited to the land necessary for the collectors, the land necessary for the electrical building, and an easement for the electrical and discharge lines to and from the collector. A maintenance easement, allowing access to the collector, would also be

PROJECT ELEMENTS OF THE SAND CITY 3 MGD DESALINATION PLANT

FIGURE 4-8



SOURCE: STAAL, GARDNER & DUNNE, INC.

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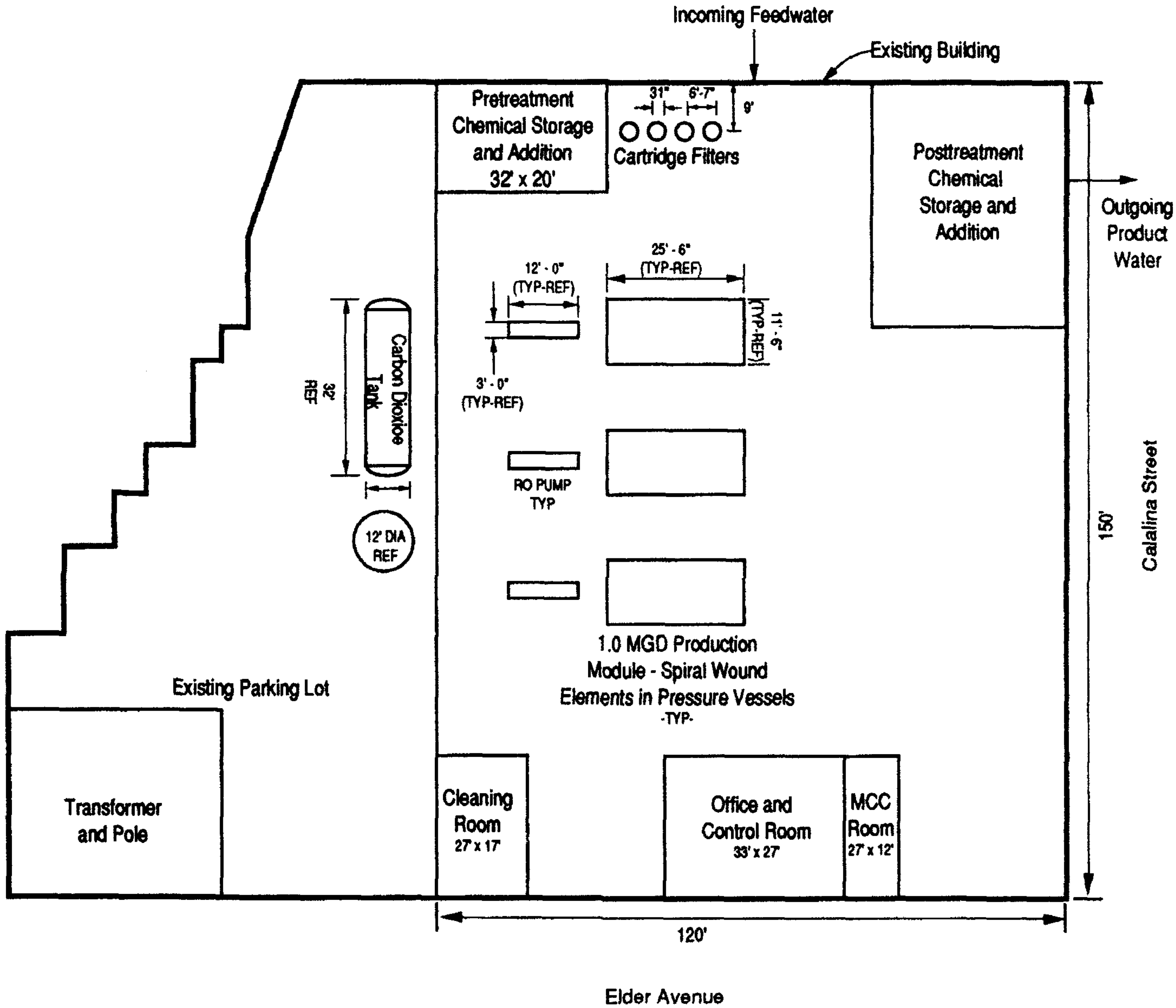
SAND CITY 3 MGD DESALINATION PLANT
PRELIMINARY SITE PLAN

FIGURE 4-9



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SOURCE: JAMES M. MONTGOMERY ENGINEERS

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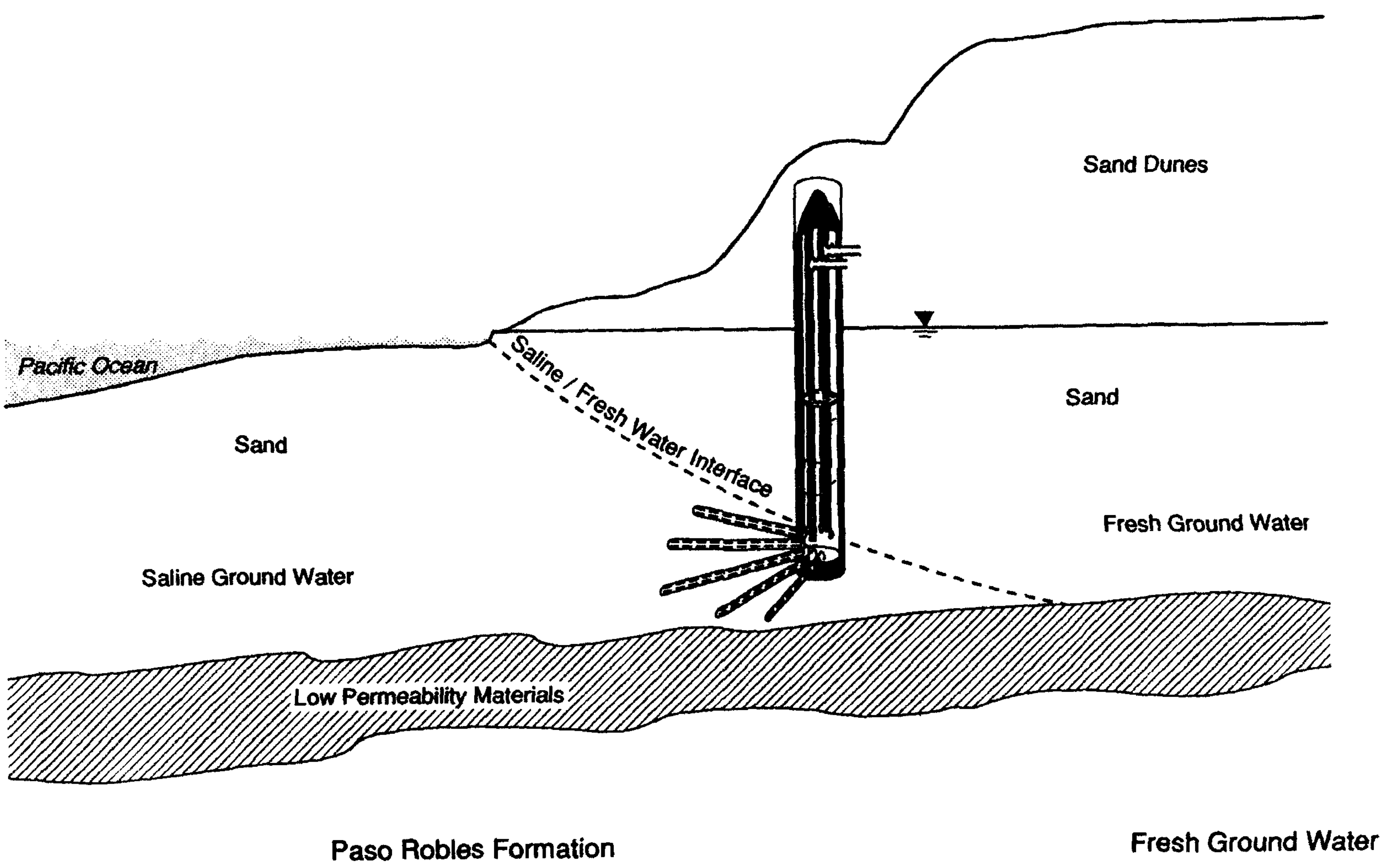
TYPICAL RANNEY COLLECTOR

FIGURE 4-10



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SOURCE: STAAL, GARDNER & DUNNE, INC.
NO SCALE

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necessary for periodic servicing. The actual geometry and square footage of the area that would need to be dedicated would vary with each collector site. For planning purposes, a minimum easement width of 50 feet extending from the collector to the public roadway would be necessary.

The feed water pipeline from the three Ranney collectors would be routed along existing City rights-of-way. Boring and jacking would be used to construct the pipeline underneath Highway 1 into one of the parcels proposed for the storage tank at the Sand City site (APNs 011-177-12 and 011-177-13). If these parcels are unavailable, the boring and jacking could terminate at the west end of Ortiz Street. Depending on field conditions, it may be possible to lengthen the bore and jack so that it extends from the west side of Sand Dunes Drive to the east side of Highway 1. Alternately, conventional open-trench construction would be used to cross Sand Dunes Drive.

4.2.2 PRETREATMENT

By using Ranney collectors to supply seawater, the need for an extensive pretreatment system would be eliminated. Filtration through the beach sands would remove most of the suspended material in the seawater. Pretreatment requirements would be limited to anti-scalant addition and cartridge filtration.

Anti-Scalant Addition

To prevent the precipitation of chemical complexes such as calcium carbonate ($CaCO_3$) and calcium sulfate ($CaSO_4$) during the reverse osmosis process, an anti-scalant would be added to the water as a first step in the treatment process. The anti-scalant would be a threshold inhibitor such as poly-acrylates. It would be delivered and stored in 55-gallon drums, and be fed using a metering pump.

Cartridge Filtration

Cartridge filters with an effective pore size of 5 microns would be used prior to the reverse osmosis system as an additional barrier to membrane fouling particulates in the seawater. The cartridge filters would be changed when headloss increased to 15 pounds per square inch (psi) and would be disposed of in a sanitary landfill.

4.2.3 RO PLANT COMPONENTS

The reverse osmosis system would consist of membrane modules and high pressure feed pumps with energy recovery. A membrane cleaning system is necessary to periodically remove fouling material.

Membranes

Each membrane module would consist of a set of pressure vessels that would be operated independently, allowing one module to be shut down for cleaning or other maintenance while the other modules are kept in operation. This would also enable water to be produced in incremental amounts during periods of reduced water demand.

The recovery rate for the reverse osmosis system would be 40 percent. In other words, for a reverse osmosis permeate production rate of 3.0 MGD, 7.5 MGD of seawater would have to be treated. The brine flow rate for this production rate would be 4.5 MGD. A 45 percent recovery rate would marginally reduce the total cost of the water, but would result in higher total dissolved solids (TDS) concentrations in the product water. The higher TDS concentration would reduce the quality of the product water.

It is recommended that spiral-wound membranes be used rather than hollow fiber membranes because they are less prone to fouling than hollow fiber membranes. In addition, technological advances are more likely to be realized with this technology than with hollow fiber membranes.

High-Pressure Feed Pumps

The feed water to the membrane modules would be pressurized to approximately 1,000 psi using three or more high-pressure feed pumps. To allow the modules to operate separately, each module would be fed with a single feed pump. To produce the high pressures required for the reverse osmosis process, multi-stage centrifugal pumps are recommended. An energy recovery system would be incorporated into the high-pressure feed pump system. Reverse-running pumps would be used to recover a portion of the energy in the brine stream. Depending on the equipment selected, approximately 35 percent of the energy in the feed stream may be recovered. In this manner the overall energy demand by the feed water pumps would be reduced.

Membrane Cleaning

With normal operation of the reverse osmosis system, material would accumulate on the membrane surface. These materials may include organic and inorganic materials too small to be removed by the cartridge filters. The accumulation of these materials leads to membrane fouling and a reduction in system performance, and higher feed pressures would be needed to maintain the same water production rate. To remove the fouling material and restore system performance, the membranes would be taken off-line and cleaned, using chemical detergents and surfactants, such as sodium dodecylbenzenesulfonate ($C_{18}H_{29}NaO_3S$) and sodium tripolyphosphate ($Na_5O_{10}P_3$). The pH of the water used to flush the membranes before and after cleaning would be adjusted using sodium hydroxide (NaOH) and sulfuric acid (H_2SO_4). These are chemicals that, once diluted, are typically discharged to a sanitary sewer after use. The pH of the spent cleaning agents may have to be adjusted prior to disposal. The cleaning agents, sodium hydroxide, and sulfuric acid would be delivered to the site as a concentrate in 50-gallon drums. A 1,500- to 2,500-gallon tank would be used to dilute the cleaning agents with warm water (95°F). During a typical cleaning procedure, the diluted cleaning solution would be circulated across the membranes for one hour, followed by a soaking period of at least one hour, and then recirculated for an additional 30 minutes.

Other cleaning agents are available, including proprietary mixtures sold by companies specializing in membrane cleaning compounds. Final selection of cleaning agents, equipment, and procedures would be based on the recommendation of the membrane manufacturer and would be defined during final design. The frequency of membrane cleaning is dependent on the quality of the feed water. For a desalination facility at the Sand City site, a semi-annual cleaning frequency is anticipated.

4.2.4 POSTTREATMENT

The reverse osmosis permeate would need to be posttreated to control corrosion and provide a disinfectant residual. Corrosion control treatment is necessary to reduce the corrosion of water transmission and distribution pipelines, service lines, and building plumbing. Disinfectant addition would be required to protect against pathologic microbial growths in pipelines and to comply with the requirements of the California Surface Water Treatment Rule (SWTR).

Corrosion Control Treatment

Chemicals such as lime and carbon dioxide may be added to the desalinated water to make it non-corrosive. Alternatively, the corrosive characteristics of the reverse osmosis permeate may be adjusted by blending the permeate with water from Cal-Am's wells. The advantages and disadvantages of these two approaches to corrosion control are discussed in this section.

Lime/Carbon Dioxide Addition

To increase the alkalinity and hardness, lime ($Ca(OH)_2$) and carbon dioxide (CO_2) could be added to the reverse osmosis permeate. Alkalinity is increased by the formation of bicarbonate ions (HCO_3-), and hardness is increased by the addition of calcium ions (Ca^{+2}). The following reaction sequence illustrates this process:

$$Ca(OH)_2 + 2CO_2 \rightarrow Ca(HCO_3)_2$$
$$Ca(HCO_3)_2 \rightarrow Ca^{+2} + 2HCO_3^-$$

Lime would be delivered to the plant site in a powder form that would be pre-slaked (i.e., the lime would be hydrated prior to delivery). The lime could be stored on site either in bags or in a silo. A 1,400-cubic-foot silo would be necessary for about 30 days of storage capacity at a production rate of 3 MGD. The lime would be dispensed using a dry feeder (gravimetric or volumetric) to a dissolving tank with a mechanical mixer. The lime solution would be fed to the product water pipeline downstream of the booster pumps.

Carbon dioxide would be delivered to the plant site in a liquid form under pressure. The liquid carbon dioxide system would consist of an insulated pressure storage tank, refrigeration unit, vaporizer, vapor heater, and control valves and meters. The carbon dioxide would be fed in vapor form through a set of diffusers at a point just downstream of the lime addition point.

Posttreatment with lime and carbon dioxide would have more operational and maintenance requirements than a blending system. Handling and feeding lime are labor-intensive processes because lime has a tendency to "bridge" in storage silos, requiring operators to manually dislodge the lime for dispensing. Mechanical agitators may be installed in the silo to partially alleviate this problem. In addition, hydrated lime is a fine powder that is difficult to handle and tends to form dusts

that are an irritant. Dust collection equipment would be installed on the silo to help abate this problem. Handling and feeding liquid carbon dioxide is less troublesome than handling and feeding lime.

Blending With Well Water

An alternative to adding chemicals to reduce the corrosivity of the reverse osmosis permeate would be to blend the permeate with well water from Cal-Am's Seaside wells. This would eliminate the need for lime and carbon dioxide storage and feed equipment. In addition, blending the two waters would result in less hard water being served to Cal-Am's customers.

A possible blending scenario would consist of blending the two waters in the treated water storage tank in the vicinity of Sand City. A pipeline would be constructed to convey the Cal-Am well water to the storage tank. This pipeline may only have to be constructed between a connection point in the Cal-Am water distribution system in the Seaside area and the blending tank. Alternatively, a dedicated pipeline would need to be constructed from several of the Cal-Am well sites to the blending tank. The operation of the desalination plant and the Seaside wells would have to be coordinated to ensure an adequate blending ratio for corrosion control of the water. (A blending ratio of at least one part well water with four parts desalination permeate would be necessary.) The success of the blending option is highly dependent upon the flow conditions within Cal-Am's distribution system. A detailed hydraulic model of the system would need to be used to fully investigate this option. Such a model is currently being developed by Cal-Am and should be available for use prior to initiation of final design.

For the Sand City site, the blending option appears the most favorable method of posttreatment.

Disinfectant Residual

A disinfectant would need to be added to the product water from the reverse osmosis treatment plant to help prevent microbial growth in the product water pipeline. Also, the disinfection requirements of the SWTR would have to be met.

Sodium hypochlorite (NaOCl) is proposed to produce a free chlorine (HOCl/OCl-) residual in the permeate. Sodium hypochlorite solution (12.5 percent chlorine) would be delivered to the desalination plant site by tank truck and stored in a crosslink polyethylene (CPE) tank. This would

provide about 30 days of storage for a 3 MGD plant. Containment walls would be constructed around the tank to contain any spills. The sodium hypochlorite would be fed using metering pumps to a point downstream of the permeate booster pumps. Provisions would be taken to prevent chlorinated water from being drawn into the reverse osmosis modules when the desalination plant is shut down.

The SWTR contains disinfection requirements that would need to be met if the State Department of Health Services (DOHS) considers the seawater supply to be either a surface water source or a groundwater under the direct influence of a surface water. To comply with the disinfection requirement, a disinfectant residual and contact time before the delivery of the water to the first service connection would be maintained. For a reverse osmosis desalination project, the disinfection system should be able to provide a minimum of 0.5 log inactivation of Giardia. The amount of inactivation credit given for disinfection systems is based on the CT concept (disinfection concentration times contact time). The State DOHS has adopted a set of tables of CT levels for chlorine disinfection for achieving different levels of inactivation of Giardia under different pH and temperature conditions. Adequate disinfectant contact time would be provided in the terminal storage reservoir proposed to be constructed in the Sand City area.

4.2.5 PRODUCT WATER TRANSMISSION LINE

Figure 4-8 shows the location of the treated water pipeline for the Sand City site. The booster pump station would be located near the Sand City plant site, while the product water transmission pipeline would travel approximately 1,000 feet south along the east side of Catalina Street to the proposed Cal-Am tie-in at the intersection of Catalina Street and Olympia Street. The proposed tie-in is a 14-inch pressure line with a hydraulic grade line of approximately 300 feet MSL.[20]

Pumping Stations

The pumping station layout for boosting out of a terminal storage reservoir in Sand City to the Cal-Am distribution system would consist of two primary pumps and one standby pump (each 200 HP). The multiple-pump design would allow operators to run the plant at different production rates.

Treated Water Storage

With the Sand City site, a storage tank located near the treatment plant would serve as both a clear well and as equalization storage. At the Sand City site, the District is considering acquisition of two parcels (APNs 011-177-12 and 011-177-13) north of the end of Catalina Street for storage of treated water. The site is shown on Figure 4-8.

4.2.6 BRINE DISPOSAL

The brine would be disposed of by injection into the shallow dune sand aquifer in the vicinity of Sand City. The brine would be injected through the use of two Ranney collectors operated in reverse (Ranney "injectors"). The brine pipeline would exit the plant and parallel the seawater feed line underneath Highway 1; the pipeline would then turn north along Sand Dunes Drive to the intersection with Tioga Avenue. The first Ranney injector would be located approximately 120 feet east of the existing high water line at the end of Tioga Avenue, while the second Ranney injector would be located approximately 800 feet to the north of the first Ranney injector. This minimizes the length of brine pipeline that would be necessary.

4.2.7 PROJECT CONSTRUCTION

Construction of the Sand City project would involve the construction of the desalination plant itself within an existing building, structural modification of the building to meet current seismic design criteria, and construction of the Ranney collectors, storage tank, pump station, and all associated pipelines. Equipment likely to be used includes loaders, dump trucks, and bulldozers for earth moving and pipeline trenching; and generators, welding machines, cranes, air compressors, and various air-and electric-powered hand tools for plant construction. Concrete would be delivered to the site by ready-mix trucks; other materials, equipment, and mechanical and electrical components would also be delivered by truck. Crew size would peak at about 30 workers; workers would commute to the site and typically work eight- to ten-hour days, five days per week. Construction of the desalination plant would last for approximately 15 to 18 months.

Pipelines

Pipelines would be constructed using conventional trench and fill methods. The pipeline trenches would be excavated by contemporary construction methods to a width of about four feet. Trench depth would vary depending on terrain; generally, it would be about seven feet. The trench walls

would be shored or braced in order to support vertical walls in potentially unstable materials. The bottom of the trench would be lined with bedding material, and pipe sections would be lowered into the trench by a mobile crane. The pipe sections would be joined, and the trench would be backfilled with the excavated spoils and compacted. Leftover spoil material would be trucked off site for disposal. Street surfaces would be repaved and restored to their original condition, and other disturbed areas would be restored and revegetated.

Pipeline construction crew sizes would vary, but typically consist of about 20 workers and their equipment. Typical pipeline construction would proceed at an average rate of about 1,000 feet per week; progress would be faster or slower depending on the terrain. The construction area would have a minimum width of 25 feet to accommodate the trench itself, excavation machinery and spoils removal or storage. Where sufficient room is available, the construction area would be 35 to 50 feet wide. Crossings of Highway 1 and the Southern Pacific Railroad would be accomplished by boring and jacking.

Ranney Collectors/Injectors

Ranney collectors would be used to provide raw seawater to the Sand City desalination plant, and to discharge the RO process brine to Monterey Bay. Ranney collectors are constructed by excavating a hole the size of the caisson (16 feet in diameter) and placing a section of concrete caisson in the hole. The weight of the caisson causes it to sink into the sand deposits. The material on the inside of the caisson is then removed, allowing it to sink farther. As the caisson sinks and material is removed, additional sections of caisson are added and joined to the previous section. Once the caisson reaches the desired depth of about 50 feet, five lateral collectors would be driven about 120 feet seaward into the beach sands through precast holes in the caisson. These lateral collectors are driven in sections that are welded together until the desired length of laterals is reached. Submersible pumps are then installed in the caisson to draw water up into a pipeline. The proposed Ranney collectors would be located about 100 feet from the ocean. The injectors would involve the same construction methods, with slight variations. The two injectors would be placed 120 feet inland of the mean high tideline, and would be constructed with three 250-foot laterals. Pumps would not be necessary for brine injection purposes.

4.2.8 PROJECT OPERATION

In the CVSIM simulations, project operations for the 24 NLP/D alternative was guided by two concepts: conjunctive use and bypass. Both of these concepts are described in Section 4.1.3. Basic operations would be similar to those of the 24 NLP alternative.

Specific Operations

The operational decisions for the 24 NLP/D alternative would be similar to those described for the 24 NLP, except that production from the desalination plant would be included (see Figure 4-11).

Reservoir Operations

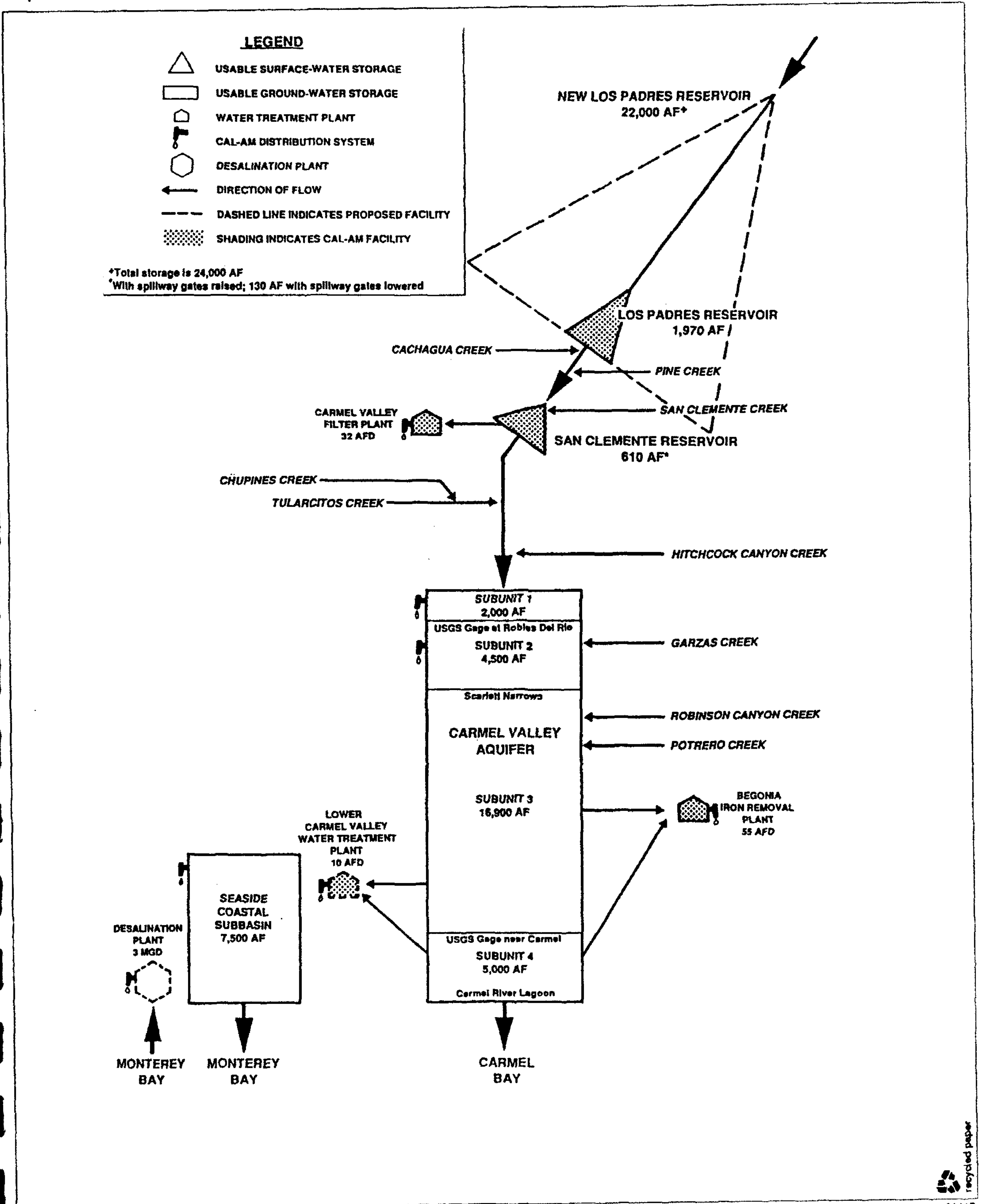
Other than the inclusion of production from the proposed desalination plant, the 24 NLP/D Reservoir is operated in the same manner as the 24 NLP alternative. These operations are described in Section 4.1.3.

Desalination Plant

A 90 percent efficiency factor has been assumed for the operation of the proposed desalination plant. For a 3 MGD plant, this equates to a maximum capacity of 8.29 acre-feet per day or approximately 3,000 acre-feet per year. In the Carmel Valley Simulation Model (CVSIM), water production from the desalination plant was maximized on the first iteration, prior to production from all other sources.[21] For the SD EIR/EIS-II analysis, a simplified seasonal operations plan was developed and included in CVSIM. Under this plan, production was maximized during the normal dry season, April through November, and minimized during the normal wet season, December through March. If the water supply conditions were classified as below normal, dry, or critically dry during the wet season, production from the desalination plant would remain at maximum until normal water supply conditions returned. The decision to continue maximum production was made at the beginning of each month based on Carmel River inflow to date and inflows expected for the remainder of the water year.

Similarly, if conditions were wetter than normal in either April or May and Carmel River flow to the Lagoon exceeded 40 cfs, production from the desalination plant would be deferred until June 1. In

OPERATIONAL SCHEMATIC FOR 24,000 AF NEW LOS PADRES RESERVOIR / 3 MGD DESALINATION FIGURE 4-11



SOURCE: MPWMD

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all cases, production was maximized during the months of June through November, inclusive. The principal objective of this plan was to reduce groundwater pumping from the Carmel Valley Aquifer during dry periods and provide some measure of environmental relief.

This seasonal operations plan would result in an average annual production from the 3 MGD desalination plant of about 2,400 AF. During wet years, production would be reduced to 1,900-2,100 AF; during dry years, the desalination plant would be operated all year and would produce about 3,000 AF. It is recognized that additional refinements to the operations plan may be developed during the final design of the project. Another possible operations with the 24 NLP/D alternative is to operate the desalination plant as a "standby" facility. This would entail producing water from the desalination plant only during dry or critically dry periods. The balance of the time, the desalination plant would be shut down and not operated except for maintenance activities. With this type of operation, production costs would be significantly reduced as the plant may be needed less than 25 percent of the time.

4.2.9 WATER SUPPLY PHASING AND YIELD

The overall phasing of yield for the 24 NLP/D alternative would be identical to that described for the 24 NLP alternative in Section 4.1.4. As described in Chapter 5, the simulated firm yield from the combination 24 NLP/D alternative at buildout would be 21,019 AF in simulated water year 1990, or about 88 percent of the Cal-Am demand expected in a severe drought year. The 24 NLP/D project yield would fall just short (about 400 AF less) of the District Board's 90 percent performance goal in one out of 90 simulated years, and result in an eight percent shortage in one other year. As shown in Table 4-7, the 24 NLP/D alternative could support about 34 years of growth, assuming a growth rate of 160 AF/year, beginning with a base Cal-Am production of 17,359 AF.

4.2.10 PROJECT TIMELINE

In terms of timing of facilities, there are two scenarios that could occur with the 24 NLP/D alternative. The first scenario entails completion of a 3 MGD desalination plant in Sand City by 1995, as part of the District's Near-Term Water Supply Program. Construction of the desalination plant depends on a successful authorizing election, which is scheduled for June 1993. Assuming an additional 1,500 AF for new growth from the Near-Term Desalination Project, the 24 NLP reservoir component would not be needed for municipal water supply until after the year 2000. It should be

noted that the reservoir component would be needed immediately to provide instream benefits. Thus, the District would continue to pursue approval for a new dam as soon as possible.

If the Near-Term Desalination Project election fails, the reservoir would be built as soon as possible (see Section 4.1.5). Assuming a growth rate of 160 AF/year of new production beginning in the year 1995, the desalination component would need to be added by about the year 2015 to maintain the municipal water supply performance desired by the District.

4.3 15,000 AF CAÑADA RESERVOIR WITH 3 MGD DESALINATION PLANT (15 CAN/D)

The 1991 SD EIR/EIS evaluated a 25,000 AF Cañada Reservoir as a stand-alone project. This alternative was not considered to be feasible because its cost would be more than twice that of the 24,000 AF New Los Padres Reservoir, with no improvement in water supply. However, state and federal reviewing agencies requested that the District evaluate a smaller Cañada Reservoir combined with desalination.

This project alternative would involve the construction of a 15,000 AF off-stream pumped-storage reservoir and dam in the Cañada de la Segunda on the north side of Carmel Valley (see Figure 4-1), and construction of a 3 MGD desalination plant at the Sand City site previously described in Section 4.2. The project would capture excess flows in the Carmel River by means of a river intake facility for transmission to and storage in the proposed reservoir for subsequent municipal use. There would be no instream releases of stored water into the Carmel River.

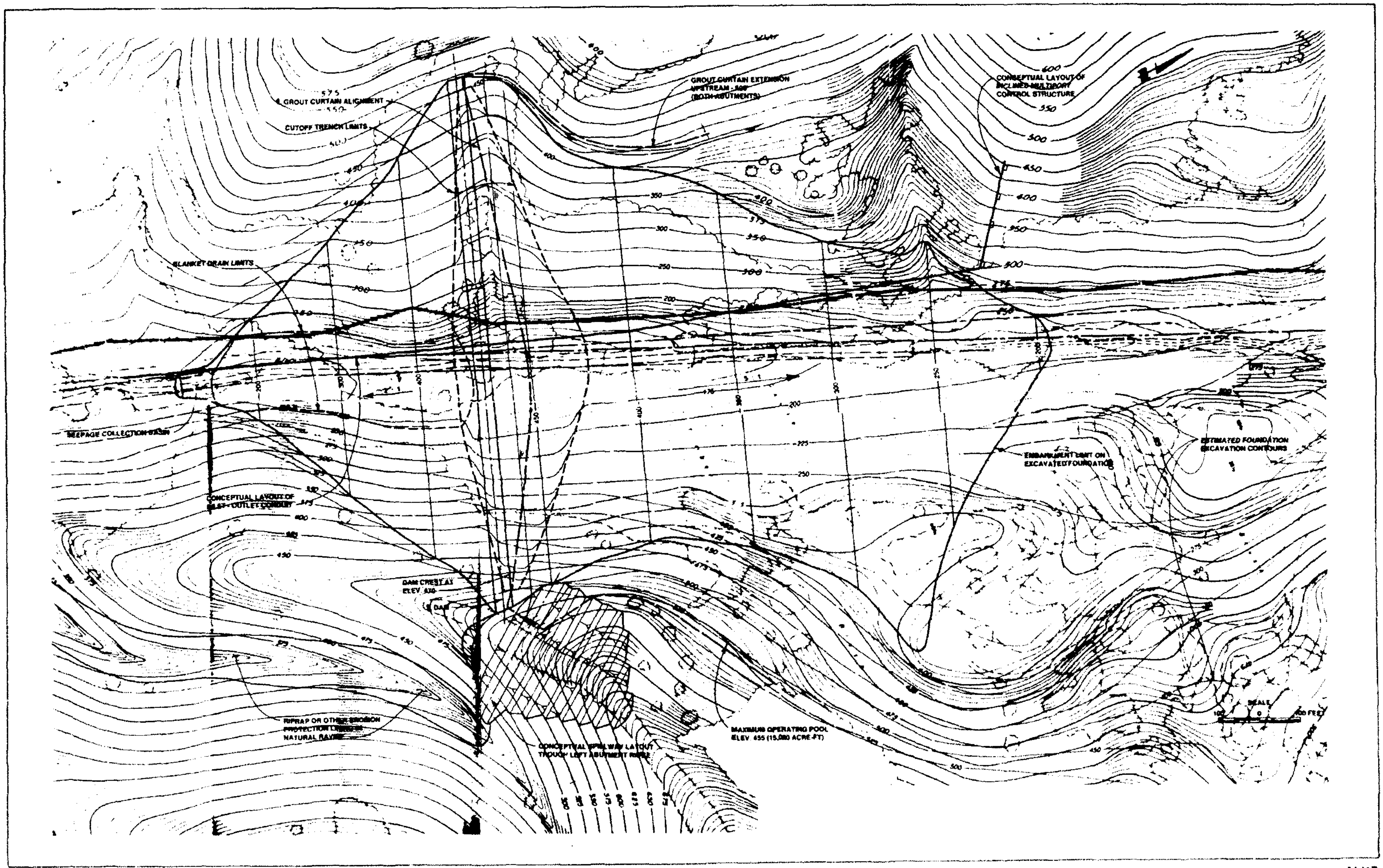
4.3.1 PHYSICAL CHARACTERISTICS

The proposed Cañada Dam would be an earth- and rock-fill embankment dam with a height of 227 feet above the existing streambed, a crest width of 40 feet and a crest length of 1,310 feet. The upstream embankment would be at a 5:1 slope, while the downstream embankment would be at a 2:1 slope. The proposed dam would have a volume of 6.6 million cubic yards, including about 939 thousand cubic yards of material imported from outside the area. Figure 4-12 shows a plan view of the proposed dam and spillway, and a cross-section of the proposed dam is shown in Figure 4-13.

The proposed Cañada Reservoir would have a normal maximum water surface elevation of 455 feet msl. With a dam crest elevation of 470 feet, there would be 15 feet of freeboard. At the normal

PLAN VIEW OF 15,000 AF CAÑADA DAM

FIGURE 4-12



SOURCE: WAHLER ASSOCIATES

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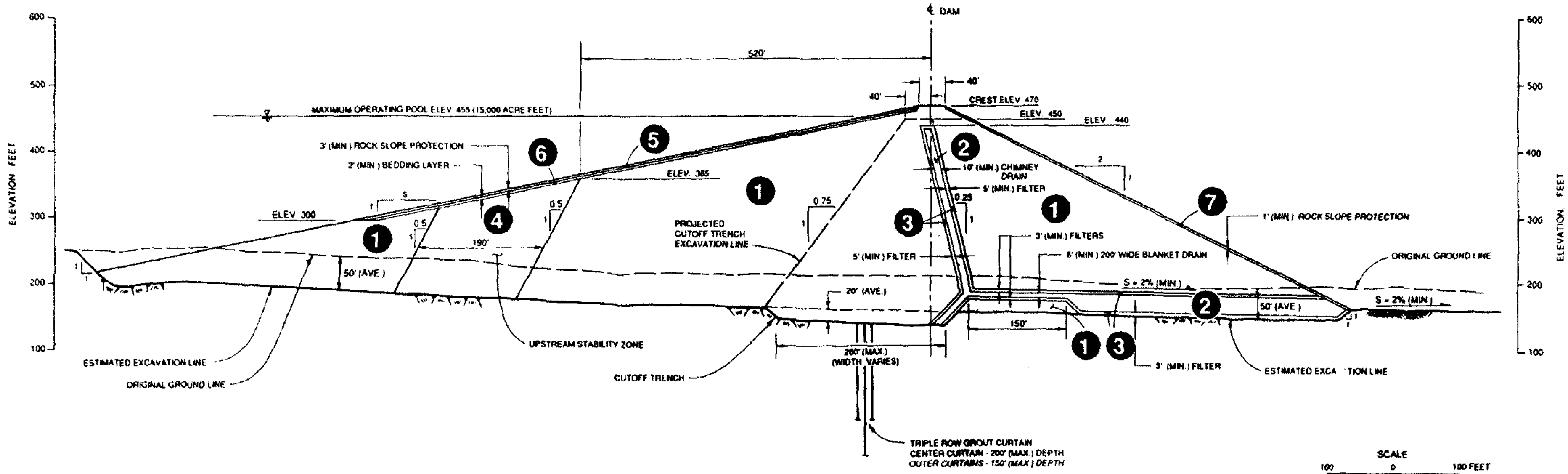
SECTION VIEW OF 15,000 AF CAÑADA DAM

FIGURE 4-13



EMBANKMENT MATERIALS			
Symbol	Zone	Description	Description
1	Zone 1	General Embankment Fill - Gravelly Silty Sand to Silty Sandy Gravel Soil-Rock Mixture	On-Site
2	Zone 2	Drain - Clean Gravel	Import
3	Zone 3	Filter - Clean Sand	Import
4	Zone 4	Upstream Stability Zone - Clean Sand to Sand - Gravel Mixture	Import
5	Zone 5	Upstream Slope Protection - Sound Rock	Import
6	Zone 6	Bedding Layer - Clean Sand - Gravel Mixture	Import
7	Zone 7	Downstream Slope Protection - Sound Rock	Import

SOURCE: WAHLER ASSOCIATES

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maximum operating elevation of 455 feet, the reservoir would contain about 15,000 AF of gross storage, and would have a surface area of 200 acres. About 500 AF would be reserved for sedimentation and dead storage, leaving 14,500 AF of active storage available. Figure 4-14 shows a map of the proposed reservoir.

A spillway would be constructed through the narrow ridge that forms the left dam abutment (see Figure 4-12). The spillway would consist of a reinforced concrete overflow structure, with capacity to safely pass the probable maximum flood.

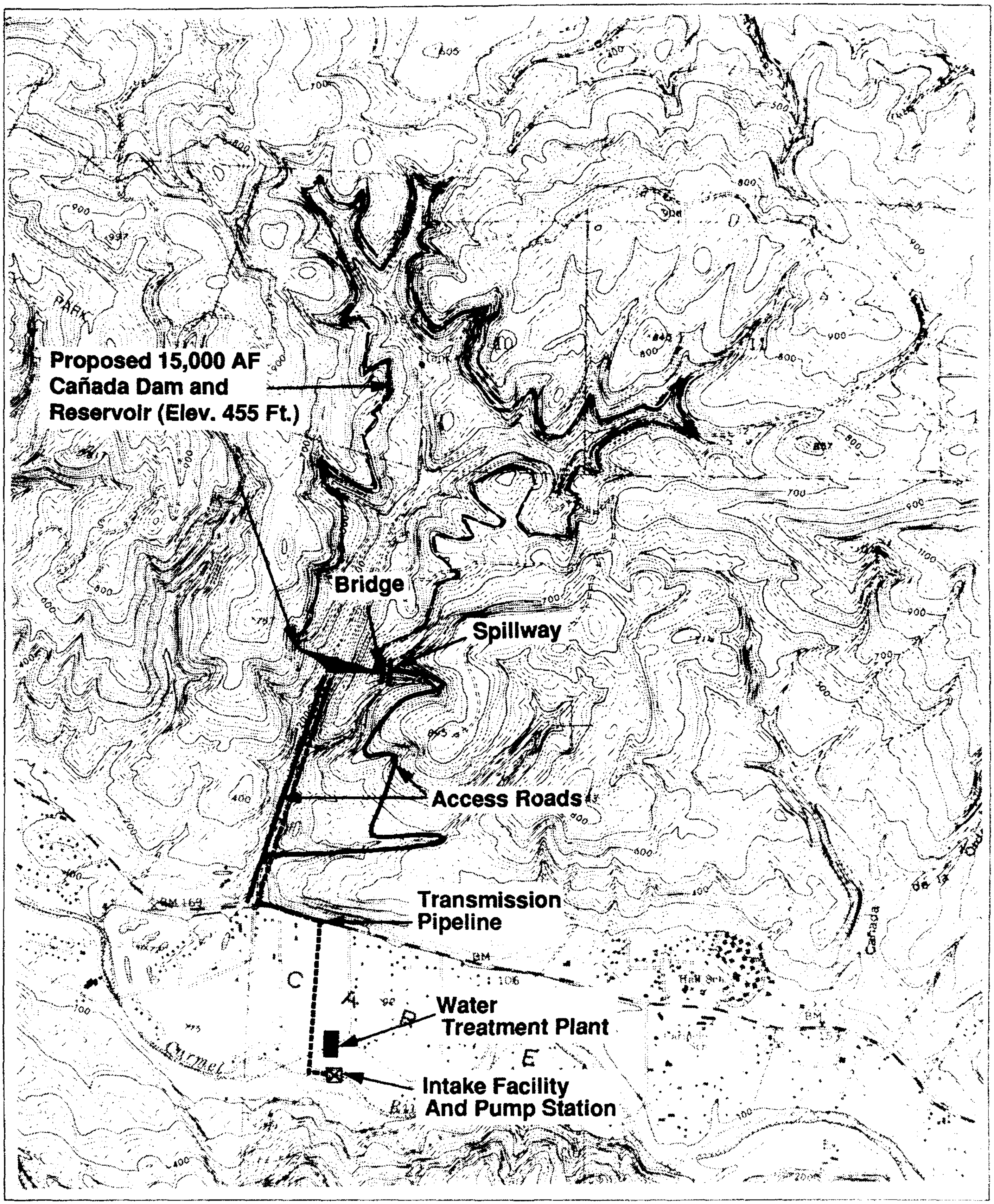
In addition to the proposed dam and reservoir, the project would also include river intake, pumping and transmission facilities with a capacity of 100 cfs. The river intake diversion would consist of a drain blanket placed directly under the bottom of the river. The drain blanket would be approximately 240 feet long, an average of 80 feet wide, and five feet thick, consisting of a layer of crushed rock placed over a layer of gabions (steel cages filled with stone). The gabions would be placed over filter material consisting of select graded rock. Figure 4-15 shows a plan view of the proposed intake.

The average amount of water that would be pumped to Cañada Reservoir is estimated to be about 11,000 AF with a range of between zero and 19,800 AF per year over the simulated period of record. The annual pumpage is a factor of the design capacity of the pumping plant, the available storage in Cañada Reservoir and the flow conditions in the Carmel River.

Horizontal collector pipes would be installed to convey the diverted water to an operating gallery along the river bank. Well screens would be provided to prevent silt and debris from entering the system. As water is withdrawn through the drain blanket, silt would tend to collect in the filter material. This silt would need to be removed by backwashing in order to maintain the diversion capacity of the intake system. Backwashing would be accomplished by diverting some of the raw water back through the collector pipes, supplemented by pressurized air through separate pipes.

The diverted water would drop into a raw water channel under the operating gallery and flow to the pump station. A cutoff wall would be installed at both the upstream and downstream ends of the drain blanket to prevent the intake system from being undermined and washed out during storm flows. The top of the upstream concrete cap would be flush with the river bottom, but the top of

PROPOSED 15,000 AF CAÑADA DAM AND RESERVOIR FIGURE 4-14



SOURCE: USGS QUAD MAP (SEASIDE)

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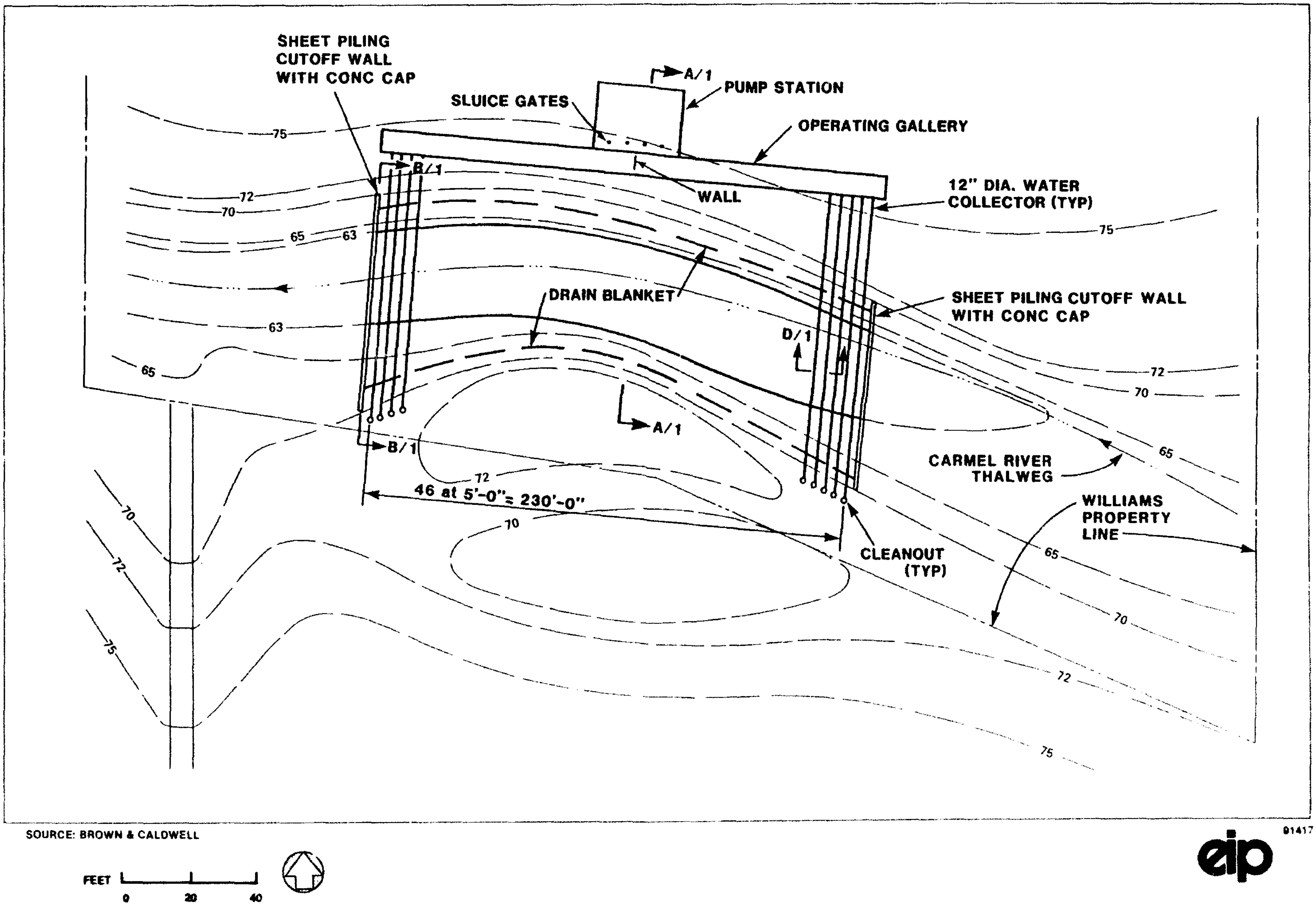
PROPOSED 15,000 AF CAÑADA RESERVOIR INTAKE

FIGURE 4-15



the downstream cap would be raised approximately 18 inches to provide a shallow pool of water for the diversion. This would result in a minimal obstruction to anadromous fish in the river, and a fishway would not be necessary. The slopes of the riverbanks, both upstream and downstream of the intake structure, would be stabilized with riprap or natural rock to ensure that the river maintains its present course. The visual appearance of the facility would be relatively unobtrusive, consisting of the concrete cutoff walls and the top of the pump station.

4.3.2 PROJECT CONSTRUCTION

The first phase of construction for the 15,000 AF Cañada Dam and Reservoir would be mobilization, or the transport of heavy earthmoving equipment, tools, materials, trailers and all other necessary equipment to the construction site. It would be necessary to store equipment and materials on-site for the duration of the construction activities; this would occur at a staging area, typically a two- to three-acre area located within the future reservoir inundation area (so as to lessen the environmental effects). Clearing of the vegetation around the dam site would also occur, and clearing of the reservoir inundation area would begin (see Section 4.1.2).

Dam foundation preparation would involve the stripping of the overburden down to solid bedrock, which in this case would involve the removal of about 50 to 140 feet of soil and weathered rock. A number of landslide masses would also be removed. This material would be removed and stockpiled within the inundation area. Some of this material could be used for reclamation and revegetation of the borrow areas, and some could be used for construction of the dam itself.

Because of the small amount of streamflow within the Cañada canyon, no coffer dam would be necessary. A grout curtain would be installed in the dam foundation to control seepage from the reservoir. Portions of the reservoir bottom would also be filled with grout to control seepage.

When the foundation is properly prepared, placement of the earthfill would begin. The earthfill material would be placed in level layers in accordance with the final design, typically in layers of six to 18 inches, and compacted with a heavy roller or other special equipment. It is important that the materials be placed at the proper water content for maximum density. Rockfill and riprap are then placed to provide stability for the embankment and to protect exposed surfaces of the fill from erosion by water currents and waves. Rockfill and riprap are normally not compacted but are dumped or placed so as to provide high shear strength. All earthfill materials would be transported

by heavy truck to the dam site from the proposed borrow areas or the reservoir inundation area. Continuous construction inspection would occur during all phases of construction to ensure that the design specifications are met. Construction of the spillway and outlet works would also occur during this period.

The final phase of construction would involve the demobilization of the construction site, or the transport of heavy equipment and other materials away from the site. Once dam construction is completed and DSOD approval is granted, the filling of the reservoir would commence. Reservoir filling would need to proceed slowly at a controlled rate to ensure the structural integrity of the dam.

The duration of construction for the proposed 15,000 AF Cañada Dam and Reservoir would be estimated at three years. Dam construction activities would occur for an average of one ten-hour shift per day, 55 workers per shift, six days per week for the three-year construction period, with less manpower being necessary at the beginning and end of construction, and peak labor force of 80 workers for a one-year period during the midpoint of construction. An average of 120 truck trips per day for three years would be necessary to deliver fill materials for the dam, equipment, concrete, piping, valves, and other supplies. No blasting is anticipated for the excavation of materials for dam construction.

Construction of the associated facilities, including the water treatment plant, raw water pump station, intake, pipelines, and other appurtenances, would need an average crew of approximately 25 workers during the three-year construction period, with a peak work crew of 50 workers for a six-month period. During the three- to four-month peak excavation period, a maximum 10 to 12 truck trips per hour would travel from the excavation sites; however, this material would be stockpiled within the inundation area and used for dam construction, hence no excavated materials would be transported on public roadways. Concrete deliveries during the peak six-month period would average 10 per day, with a maximum of 20 per day. Truck deliveries of other materials are estimated at three to five per week.

3 MGD Desalination Plant

The general construction scenario presented in Section 4.2.2 for the 24 NLP/D alternative would also be applicable to this alternative.

4.3.3 PROJECT OPERATION

In the CVSIM simulations, project operation for the 15 CAN alternative was guided by two concepts: conjunctive use and bypass as described in Section 4.1.3. The Cañada Reservoir would differ from other reservoirs in that no releases would be made from the reservoir to the Carmel River.

Specific Operations

In the CVSIM simulation, operational decisions for the 15 CAN Dam and Reservoir are similar to those for the 24 NLP alternative (Figure 4-16). Decisions regarding specific production sources are presented below.

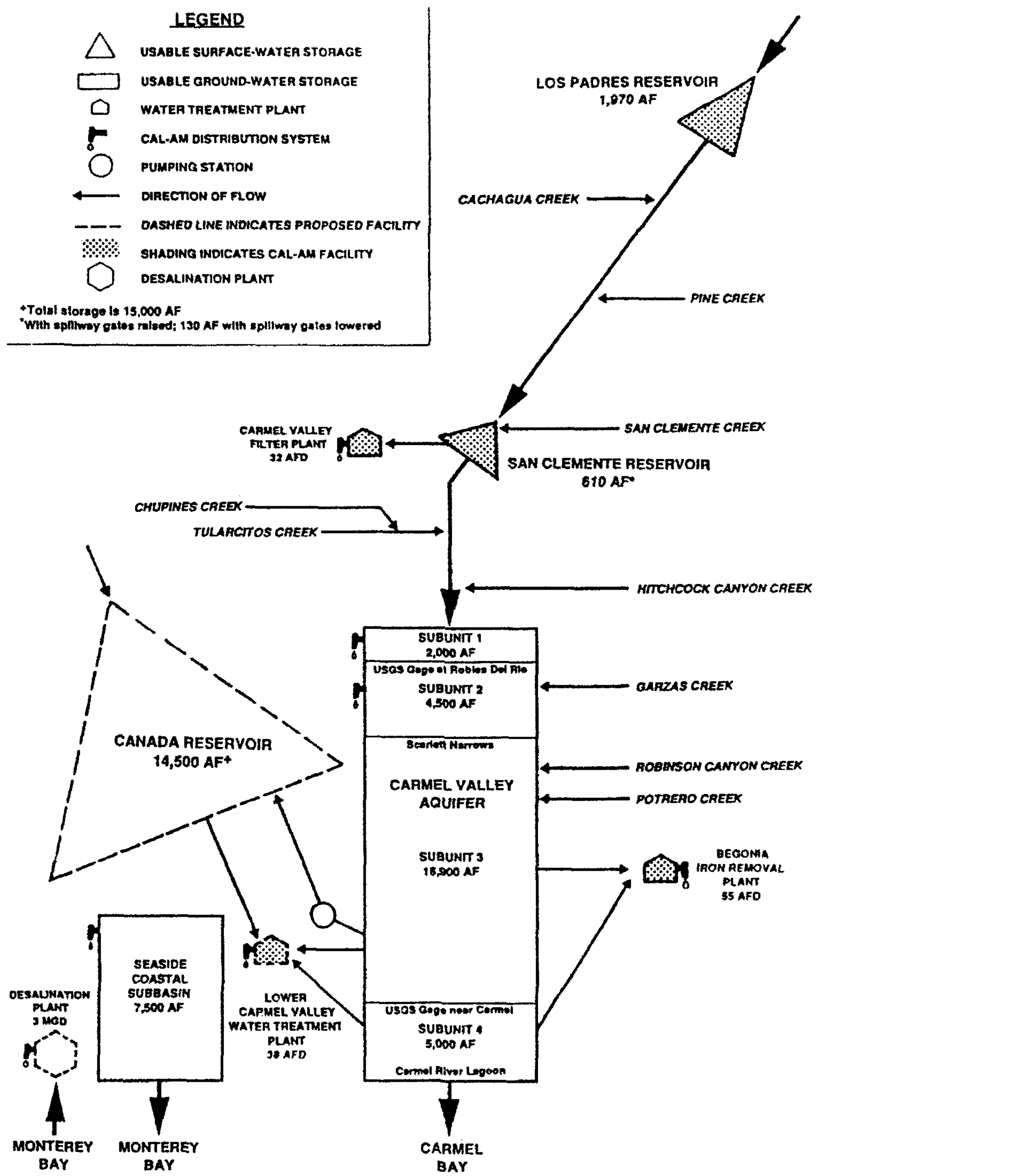
Reservoir Operations

The 15 CAN Reservoir was operated based on the bypass logic proposed by CDFG and modified by Cal-Am and MPWMD.[22] The most important modification involved the development and utilization of a conjunctive-use approach rather than a strict "baseload" operation. CDFG's original baseload concept required that storage in Cañada Reservoir be completely depleted before any pumping from the Carmel Valley aquifer would be allowed. Based on analyses of simulated baseload operations during extended drought periods, Cal-Am's consultant found that (1) duplicate production facilities would need to be constructed, (2) the Cañada Water Treatment Plant would need to be more than twice the size of a plant operated under a conjunctive-use approach, and (3) the facilities would be idle much of the time. The consultant concluded that baseload operations were not "economically feasible nor technically prudent."

As an alternative, a "modified conjunctive-use" operating rule was developed for the 15 CAN alternative. Under this rule, whenever there is flow that is in excess of the amount needed to satisfy the fishery flow requirements at the Lagoon (Table 4-4), Cal-Am would be allowed to operate its production wells in the Lower Carmel Valley before utilizing Cañada reservoir storage. If there is no excess flow, Cal-Am would not be allowed to operate its wells in the LCV or to pump water from the Carmel River for storage in Cañada Reservoir. This type of operation would allow Cal-Am to utilize ground water storage during the high flow periods with minimal impact to the Carmel River, and to preserve reservoir storage for water supply use during low flow periods.

OPERATIONAL SCHEMATIC FOR 15,000 AF CAÑADA RESERVOIR / 3 MGD DESALINATION

FIGURE 4-16



SOURCE: MPWMD

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It should be noted that some of the flow requirements shown in Table 4-4 are based on reservoir storage. For example, the flow requirement at the Lagoon in the April - May period during dry years is 30 cfs when reservoir storage is greater than 10,000 AF and 20 cfs when reservoir storage is less than 10,000 AF. This reservoir storage refers to the combined total storage in San Clemente and New Los Padres Reservoirs. This storage test is not applied to the daily flow requirements for the 15 CAN/D alternative.

In CVSIM, the decision whether or not to pump from wells in the Lower Carmel Valley (i.e. subunits 3 and 4) was made based on aquifer storage in subunits 3 and 4 and the bypass requirement calculated for the Narrows. If subunits 3 and 4 are full and the inflow at the Narrows exceeds the bypass requirement, then pumping from the Lower Carmel Valley is allowed.

More specifically, if the storage and inflow conditions are met, then pumping from one of the wells in subunit 4 would be maximized on the first iteration and no water would be produced from Cañada Reservoir. If the production from the first iteration (i.e. production from the desalination facility, San Clemente Reservoir, Seaside Coastal Subbasins, and a well in subunit 4) is insufficient to meet the required daily demand, then pumping from all of the wells in subunit 3 would be maximized on the second iteration to meet the required demand. Further, if this production was insufficient, then production from Cañada Reservoir, the second well in subunit 4, wells in subunit 2, and wells in subunit 1 would be maximized on the third, fourth, fifth, sixth, and seventh iterations, respectively, to meet the required demand.

If the storage and inflow conditions were not met, then no Cal-Am pumping from the Carmel Valley aquifer would be allowed until production from the Cañada Reservoir had been maximized. In this case, production from the desalination facility, San Clemente Reservoir, and Cañada Reservoir would be maximized on the first iteration to meet the required demand. Production from the Seaside Coastal Subbasins would be limited to a nominal amount on the first iteration. This amount would vary depending on the month and water supply status. If the production from the first iteration was insufficient to meet the required demand, then production from the Seaside Coastal Subbasins, one well in subunit 4, wells in subunit 3, both wells in subunit 4, wells in subunit 2, and wells in subunit 1 would be maximized on successive iterations to meet the required demands. During periods when the storage and inflow conditions are not met and Cal-Am is able to meet the required demand with

production from the desalination plant, Seaside wells, and San Clemente and Cañada Reservoirs, Cal-Am pumping in the Carmel Valley aquifer will be limited to maintenance pumping levels.

In CVSIM, the decision whether or not flows from the Carmel River could be pumped and stored in Canada Reservoir was made based on the bypass requirement calculated for the USGS "Near Carmel" gaging site. This site is used as the dividing line between subunits 3 and 4 of the Carmel Valley aquifer and approximates the proposed diversion site for the 15 CAN/D alternative. In the 15 CAN/D simulations for the SDEIR/EIS-II, decisions regarding diversions from the Carmel River to Cañada Reservoir were made after it had been determined whether or not there were sufficient flows to allow groundwater pumping in the Lower Carmel Valley. Thus, if there was "excess" water entering the Lower Carmel Valley, the "extra" water was first made available to groundwater pumping and then, if any excess remained, made available for diversion to the Cañada Reservoir.

It should be noted that the bypass requirement at "Near Carmel" is based on the flow requirement at the Lagoon estimated prior to groundwater pumping in subunit 3. This estimate is used so that any pumping and induced recharge that occurs in subunit 3 does not interfere with the "natural" flow that would be expected at the Lagoon.

If the inflow at "Near Carmel" is greater than the bypass requirement, the excess flow can be pumped and stored in Cañada Reservoir. This pumped storage is limited by available storage and pumping capacities. For the 15 CAN/D alternative, the maximum pumping capacity was 100 cfs or 200 acre-feet per day. In addition, a minimum pumping rate of 10 cfs was specified. No releases from Cañada Reservoir would be made for instream flow.

Cañada Water Treatment Plant

Diversions from Cañada Reservoir would be treated at the proposed Cañada Water Treatment Plant. For this EIR/EIS, a maximum capacity of 38 AF day was specified for the 15 CAN/D alternative. Diversions from Cañada Reservoir would be maximized unless sufficient streamflow is available to allow groundwater pumping in the Lower Carmel Valley without reducing the flow below the requirement at the Lagoon.

Reservoir Operations

With the 15 CAN/D alternative, Los Padres and San Clemente Reservoirs would be operated according to current agreements and practices. These operations are described in Section 4.5.3.

3 MGD Desalination Plant

The general operation scenario presented in Section 4.2.8 for the 24 NLP/D alternative would also be applicable to this alternative.

4.3.4 WATER SUPPLY PHASING AND YIELD

The overall phasing of yield for the 15 CAN/D alternative would be identical to that described for the 24 NLP alternative in Section 4.1.4. As described in Chapter 5, the simulated firm yield from the combination 15 CAN/D alternative at buildout would be 20,150 AF in simulated year 1990, or about 85 percent of the Cal-Am demand expected in a severe drought year. The 15 CAN/D project yield would fall short (about 1,500 AF less) of the District Board's 90 percent performance goal in one out of 90 simulated years, and result in shortages of seven to nine percent in three additional years. In order to attain the "90 percent goal" in severe droughts, Cal-Am production would need to be reduced to about 21,500 Af to 21,750 AF annually. Thus, as shown in Table 4-7, the 15 CAN/D alternative alone could support about 27 years of growth, assuming a growth rate of 160 AF/year of new production beginning with a base Cal-Am demand of 17,359 AF production.

4.3.5 PROJECT TIMELINE

The project timeline would be similar to the two scenarios described for the 24 NLP/D alternative in Section 4.2.10.

4.4 3 MGD AND 4 MGD DESALINATION PLANTS (7 DSL)

The 1991 SD EIR/EIS assumed a 7 MGD desalination plant at one site; project costs and locations were not clearly defined at the time. This SD EIR/EIS-II assumes that the 7 MGD desalination alternative would be built in two phases in two locations. This change is due to new design and cost information developed by the District in 1992, and the pursuit of the Sand City site for a 3 MGD Near-Term Desalination Project. A 7 MGD plant would not be feasible at the Sand City site.

The 7 DSL alternative would be constructed in two phases: first, the 3 MGD desalination plant would be constructed at the Sand City site, as previously described in Section 4.2, followed by the construction of a 4 MGD desalination plant at the Monterey Regional Water Pollution Control Agency (MRWPCA) site. A description of the 4 MGD desalination plant to be located at the MRWPCA site follows.

Facilities associated with locating the desalination facility at the MRWPCA site would include a seawater intake near the beach in the city of Marina, consisting of two Ranney collectors and a pipeline for conveying the seawater to the desalination plant; a reverse osmosis desalination system to treat the water; a posttreatment process for corrosivity control; a treated-water pump station; and an approximately 7.5-mile pipeline that would be used to deliver the product water to the connection to the Cal-Am distribution system in Seaside. Minimal pretreatment would be necessary because the raw water would be filtrated through the beach sand. The brine stream would be combined with the treated effluent from the wastewater treatment facility, and discharged to Monterey Bay through the existing MRWPCA outfall. Figure 4-17 provides an overview of the facilities associated with this alternative. The project components are discussed in additional detail below.

4.4.1 SEAWATER INTAKE

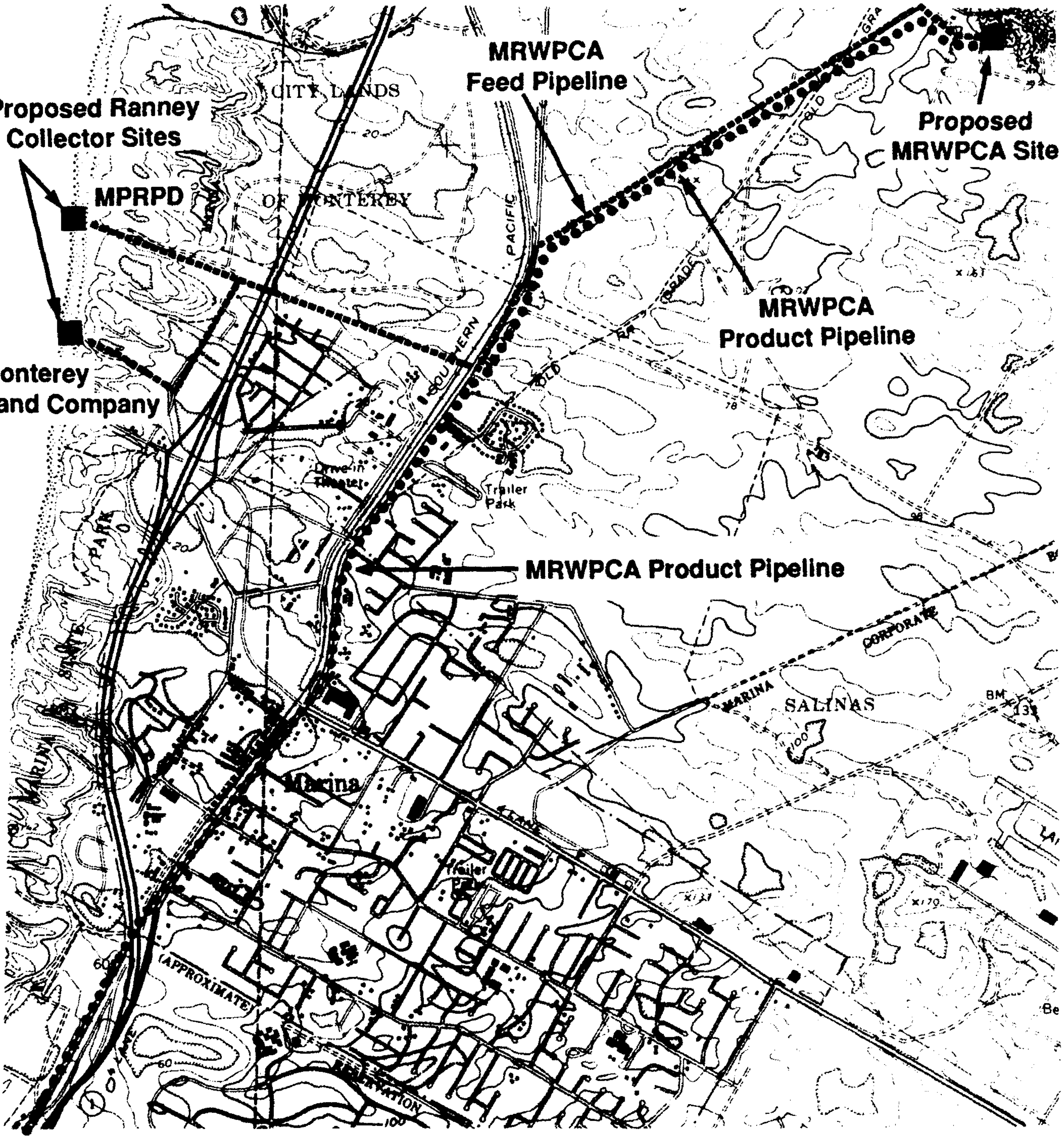
Two Ranney collectors are proposed for this alternative to provide the raw seawater. Figure 4-10 depicts a typical Ranney collector.

The MRWPCA plant site would need about 14,500 feet of pipeline to carry seawater pumped from Ranney collectors to the plant site. The pipeline from the Ranney collector located at the Monterey Sand Company site would follow either the existing private access roadway from the bluff to Dunes Drive or a different alignment if determined to be more consistent with site redevelopment. (A specific redevelopment plan for the site is not yet available.) The pipeline would then travel north in the paved portion of Dunes Drive to the Marina city boundary (see Figure 4-17). The pipe-line from the Ranney collector located at the Monterey Peninsula Regional Park District (MPRPD) site would follow the existing access road in order to minimize disruption of sensitive dunes habitat. The pipeline would join the Monterey Sand Company collector line at the north end of Dunes Drive.

From the northern end of Dunes Drive, the pipeline would continue north across the Marina city boundary, then east along the Armstrong Ranch side of the boundary (APN 203-011-08) to the

MRWPCA SITE LAYOUT - 4 MGD DESALINATION PLANT

FIGURE 4-17



SOURCE: USGS & JAMES M. MONTGOMERY ENGINEERS

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Caltrans right-of-way. (The city side of the boundary is developed private property.) The pipeline would then continue along the Armstrong Ranch side of the Marina boundary (APNs 203-011-22 and 175-011-01) to Del Monte Road.

From Del Monte Road to the MRWPCA plant site, the proposed route for the feed water pipeline parallels an existing 16-inch PG&E gas main and a 42-inch MRWPCA force main running along the northwest boundary of APN 175-011-31. The proposed permanent route is on a line running 10 feet southeast of the MRWPCA wastewater treatment plant access road to the proposed site of the desalination plant.

4.4.2 PRETREATMENT

By using Ranney collectors to supply seawater for the MRWPCA project site, the need for an extensive pretreatment system would be eliminated. Filtration through the beach sands would remove most of the suspended material in the seawater. Anti-scalant addition and cartridge filtration would be performed as described for the Sand City site in Section 4.2.2.

4.4.3 RO PLANT COMPONENTS

RO plant components would be similar to those described for the Sand City site, except that the plant would have a capacity of 4 MGD. For the MRWPCA site, using Ranney collectors, membrane cleaning on a semiannual basis would likely be sufficient. Figure 4-18 shows the site plan for this alternative.

4.4.4 POSTTREATMENT

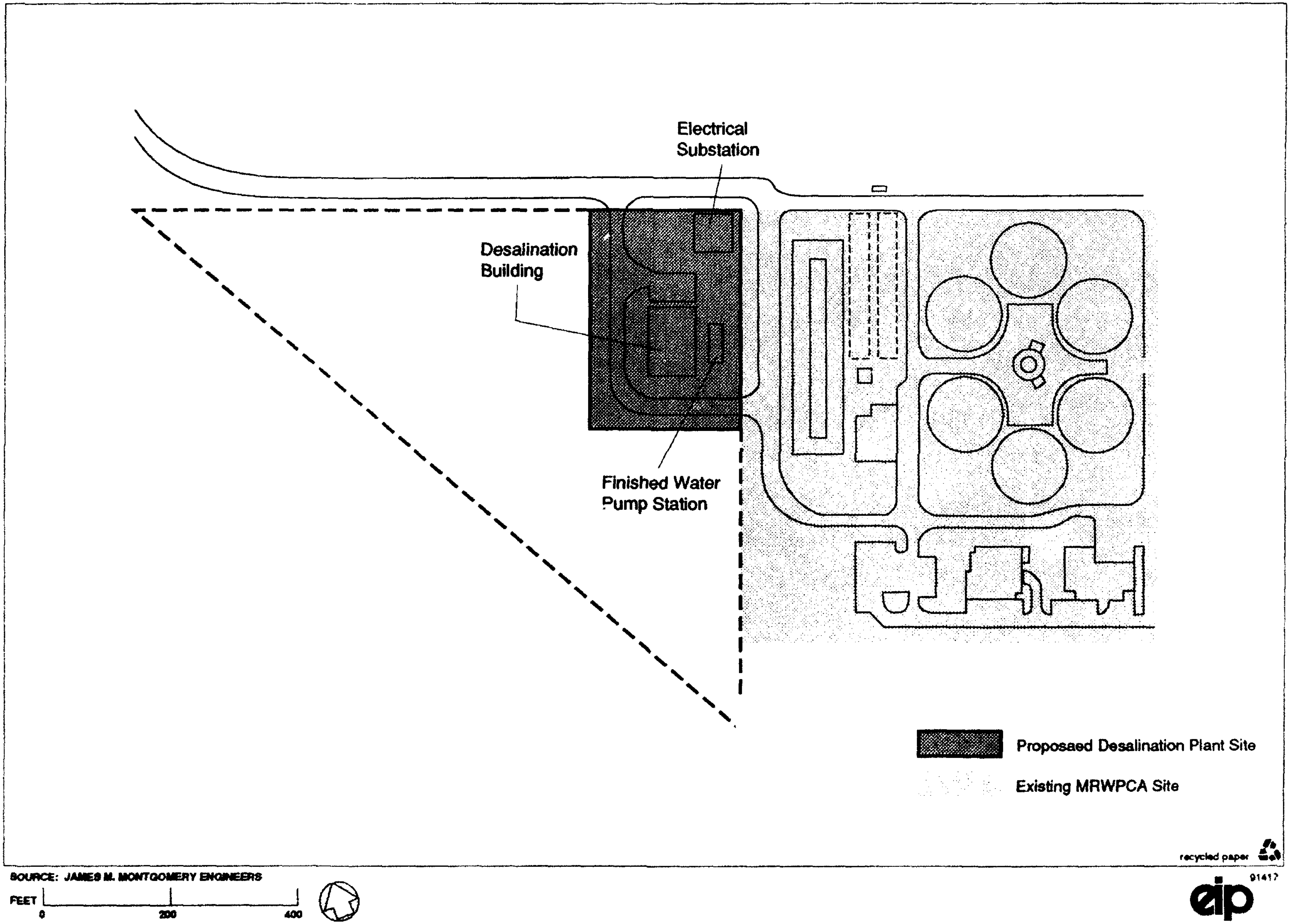
Posttreatment operations for the MRWPCA alternative site would be the same as for the Sand City site (see Section 4.2.4). The cost to construct a product water pipeline of non-ferrous materials from a desalination plant at the MRWPCA site makes treating the water with lime and carbon dioxide at the desalination plant the most feasible option.

4.4.5 PRODUCT WATER TRANSMISSION LINE

The product water route from the MRWPCA site to Del Monte Road and the City of Marina would be the same as that described above for the feed water alignment between Del Monte Road and the MRWPCA site. As shown on Figure 4-17, south of Lapis Siding Road the product water pipeline

MRWPCA SITE PLAN - 4 MGD DESALINATION PLANT

FIGURE 4-18



alignment from the MRWPCA site would follow Del Monte Boulevard to the Highway 1 corridor, which would be followed to Fremont Boulevard in Seaside, where the connection to the Cal-Am system would occur.

Pumping Stations

Because of the drop in grade from the MRWPCA site to the Seaside connection point, the hydraulics make it difficult to design a pumping station for flow rates less than full desalination plant output. A station designed with multiple-sized speed pumps may cavitate and damage the pumps when all of the pump units are not operating. To avoid this condition, either variable-speed pumping or separate smaller pumps would be needed for low flow conditions from this site. The 4 MGD pumping station at the MRWPCA site would consist of two 60-horsepower pumps; one for primary use and one standby pump.

Potable Water Tie-In to Cal-Am Distribution System

With the addition of the 4 MGD desalination plant, a total of 7 MGD of potable water would be introduced into the Cal-Am distribution system in the Seaside/Sand City area. Current Cal-Am facilities are not sized to accommodate flows of this magnitude. Therefore, a new force main (pipeline) of larger diameter would need to be constructed to convey the desalinated water from Seaside to the Pacific Grove area, where sufficient pipeline and pumping capacity are available for water conveyance. The probable tie-in to the Cal-Am system is at the pump station located at the intersection of Eardley and Sinex Avenues in Pacific Grove.[23]

Potential Locations for Terminal Storage Facilities

For the MRWPCA site, the proposed location for the connection to the Cal-Am distribution system is at the intersection of Playa Avenue and Fremont Boulevard in Seaside. There are two candidate sites for an equalization storage tank near this terminus: one is located on the north side of San Pablo Avenue just east of Fremont Boulevard; the other is at the southeast corner of Playa Avenue and the alley east of Fremont Boulevard. Either of these sites offers sufficient space to accommodate the 1.4 MG storage tank needed for a 4 MGD plant.

Surplus Water Delivery to Marina County Water District

For the MRWPCA site, the possibility exists that the Marina County Water District (MCWD) could participate in the Desalination Project. As described in Section 4.4.8 below, the operations schedule for the combined 7 MGD desalination plants would result in an average annual production of 5,500 AF per year. Production from the plant could range from a minimum of 4,300 AF to a maximum of nearly 7,100 AF per year. Consequently, there would be periods when the District would not utilize the full production capacity from the desalination plants. The MCWD has expressed an interest in purchasing "surplus" water from the Desalination Project when the District determines that it is available. The surplus water would be available in the winter months during normal and wet years, but would not be available during dry years. The MCWD has indicated that they could utilize this surplus water to reduce their long-term average demand on existing sources of supply.[24] This use could also reduce the cost per acre-foot of water utilized by the District in years when the full production capacity is not needed.

Since the product water pipeline from the MRWPCA site is routed through the City of Marina, the facilities to provide a tie-in to the MCWD distribution system would be limited to a reducing tee, a small section of pipe, a flow meter, and a remote-operated valve.

4.4.6 BRINE DISPOSAL

For the MRWPCA site, the brine stream would be conveyed to a connection with the existing MRWPCA outfall. The brine would be blended with the treated wastewater effluent prior to discharge to Monterey Bay.

4.4.7 PROJECT CONSTRUCTION

For the MRWPCA site, project construction and would last for approximately 15 to 18 months. Construction of the desalination plant, Ranney collectors and pipelines would occur simultaneously. Additional detail on the expected construction methods is provided below.

Desalination Plant

Construction of the desalination plant at the MRWPCA site would be essentially the same as that described in Section 4.2.7 for the Sand City site, although construction would be somewhat more

extensive because a building and electric substation would need to be constructed. A peak crew size of about 50 workers would be anticipated.

Pipelines

Pipelines would be constructed using conventional trench and fill methods. The pipeline trenches would be excavated by contemporary construction methods to a width of about four feet. Trench depth would vary depending on terrain; generally, it would be about seven feet. The trench walls would be shored or braced in order to support vertical walls in potentially unstable materials. The bottom of the trench would be lined with bedding material, and pipe sections would be lowered into the trench by a mobile crane. The pipe sections would be joined, and the trench would be backfilled with the excavated spoils and compacted. Leftover spoil material would be trucked off site for disposal. Street surfaces would be repaved and restored to their original condition, and other disturbed areas would be restored and revegetated.

Pipeline construction crew sizes would vary, but typically consist of about 20 workers and their equipment. Typical pipeline construction would proceed at an average rate of about 1,000 feet per week; progress would be faster or slower depending on the terrain. The construction area would have a minimum width of 25 feet to accommodate the trench itself, excavation machinery and spoils removal or storage. Where sufficient room is available, the construction area would be 35 to 50 feet wide. Crossings of Highway 1 and the Southern Pacific Railroad would be accomplished by boring and jacking.

Ranney Collectors

Ranney collectors (see Figure 4-10) would be used to provide raw seawater to the MRWPCA desalination plant. Ranney collectors are constructed by excavating a hole the size of the caisson (16 feet in diameter) and placing a section of caisson in the hole. The weight of the caisson causes it to sink into the sand deposits. The material on the inside of the caisson is then removed, allowing it to sink further. As the caisson sinks and material is removed, additional sections of caisson are added and connected to the previous section. Once the caisson reaches the desired depth of about 87 feet, four lateral collectors would be driven about 80 feet seaward into the beach sands through precast holes in the caisson. These lateral collectors are also driven in sections that are welded together until the desired length of laterals is reached. A pump is then installed at the top of the caisson to draw

water up into a pipeline. The two proposed Ranney collectors would be located about 200 feet from the ocean, separated by about 500 feet, and would be connected only by the raw water supply pipeline.

4.4.8 PROJECT OPERATION

Specific Operations

In the CVSIM simulation, operational decisions for the 7 DSL (Figure 4-19) are similar to those for the No Project alternative. Decisions regarding specific production sources are presented below.

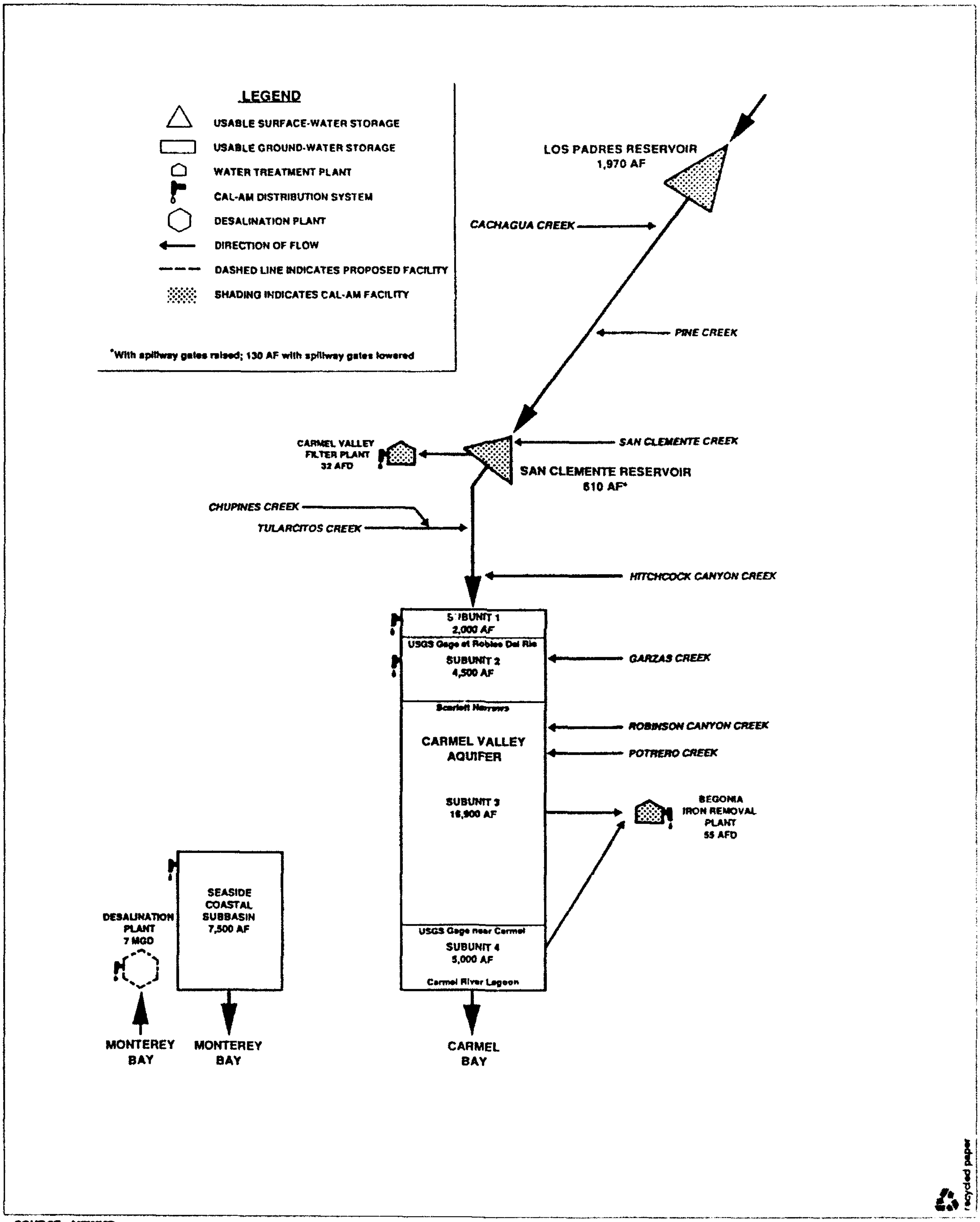
Desalination Plants

The 3 MGD and 4 MGD desalination plants would be operated in the same manner and assume a 90 percent efficiency factor. For the 7 MGD combined plant, this equates to a maximum capacity of 19.33 acre-feet per day or approximately 7,070 acre-feet per year. In CVSIM, production from the desalination plant was maximized on the first iteration, prior to production from all other sources. For the EIR/EIS analyses, a simplified seasonal operations plan was developed and included in CVSIM. Under this plan, production was maximized during the normal dry season, April through November, and minimized during the normal wet season, December through March. If the water supply conditions were classified as below normal, dry, or critically dry during the wet season, production from the desalination plant would remain at maximum until normal water supply conditions returned. The decision to continue maximum production was made at the beginning of each month based on inflow to date and inflows expected for the remainder of the water year.

Similarly, if conditions were wetter than normal in either April or May and flow to the Lagoon exceeded 40 cfs, production from the desalination plant would be deferred until June 1. In all cases, production was maximized during the months of June through November, inclusive. The principal objective of this plan was to reduce groundwater pumping from the Carmel Valley Aquifer during dry periods and provide some measure of environmental relief.

It is recognized that a more sophisticated operations plan will likely need to be developed if this alternative is implemented, particularly with respect to minimizing power costs and ensuring reliable, continuous service.

OPERATIONAL SCHEMATIC FOR 7 MGD DESALINATION PROJECT FIGURE 4-19



SOURCE: MPWMD

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Reservoir Operations

With the 7 DSL alternative, Los Padres and San Clemente Reservoirs will be operated according to current agreements and practices. These operations are described in Section 4.5.3.

4.4.9 WATER SUPPLY PHASING AND YIELD

The overall phasing of yield of the 7 DSL alternative would be identical to that described for the 24 NLP alternative in Section 4.1.4. As described in Chapter 5, the simulated firm yield from the 7 DSL alternative at buildout would be 22,761 AF in simulated year 1977, or about 98 percent of the Cal-Am demand expected in a severe drought year. No other years would entail annual shortages. The 7 DSL alternative would achieve the 90 percent goal at all times. As shown in Table 4-7, the 7 DSL alternative could support about 34 years of growth, assuming a growth rate of 160 AF/year of new production, beginning with a base Cal-Am demand of 17,359 AF production.

4.4.10 PROJECT TIMELINE

The project timeline would be similar to the first scenario described for the 24 NLP/D alternative in Section 4.2.10. A 3 MGD plant at Sand City would be constructed by 1995; the 4 MGD component near Marina would be constructed sometime after the year 2000.

4.5 NO PROJECT ALTERNATIVE (NO PRJ)

4.5.1 PHYSICAL CHARACTERISTICS

The 1991 SD EIR/EIS included a No Project alternative that reflected an estimate of future facilities and conditions without a long-term project. The No Project alternative in this SD EIR/EIS-II reflects conditions expected in the year 1993. It entails existing facilities in addition to a new Cal-Am well in the Seaside Coastal groundwater subbasin (Paralta well), as described in Section 4.6.1. The Paralta well is expected to be in production by mid-to-late 1993.

Annual water demand would be limited to 17,359 AF of Cal-Am production in a normal year, or 385 AF more than the present estimated normal year demand. Thus, the No Project alternative would not meet the basic project purpose of providing adequate supply and drought protection for planned growth.

4.5.2 PROJECT CONSTRUCTION

There would be no substantial construction activities associated with the No Project alternative.

4.5.3 PROJECT OPERATION

In the CVSIM simulations, project operation for the No Project alternative was based on existing procedures, ordinances, and agreements. For the No Project alternative, operations at Los Padres and San Clemente Reservoirs were guided by Regulation X of the District Rules and Regulations and a Memorandum of Agreement (MOA) between Cal-Am, the District, and CDFG.

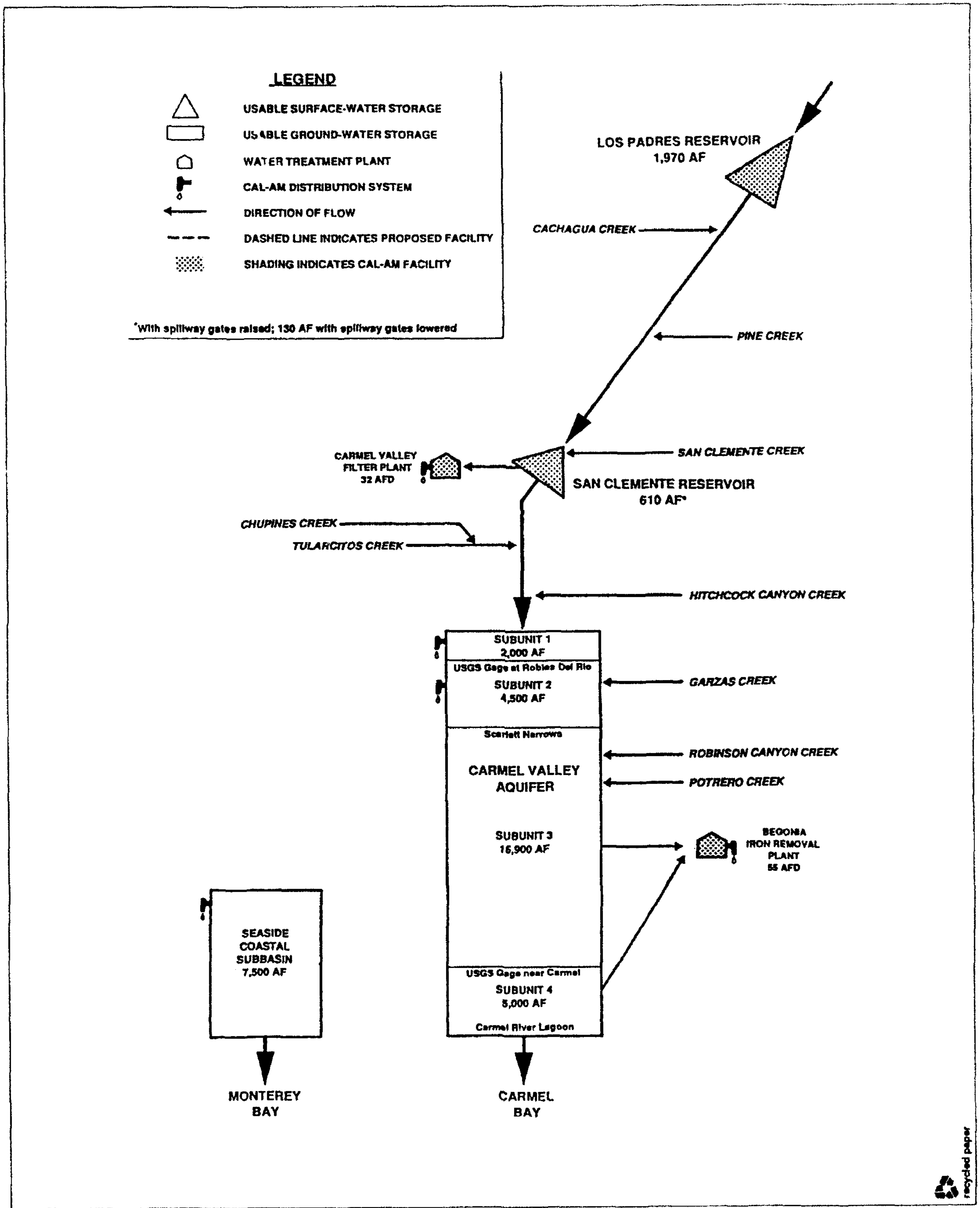
Specific Operations

In the CVSIM simulation, general operational decisions for the No Project alternative (Figure 4-20) are similar to those for the long-term alternatives described previously. Decisions regarding specific production sources are presented below.

Regulation X of the District Rules and Regulations requires development and review of a Quarterly Water Supply Strategy and Budget for the Cal-Am water distribution system.[25] This budget is prepared each December, March, June, and September and applies to the upcoming three-month period. In the budget, production values are projected for Cal-Am's four principal water sources: (1) San Clemente Reservoir, (2) Upper Carmel Valley Aquifer, (3) Lower Carmel Valley, and (4) Seaside Coastal Groundwater Basin. The budget is developed cooperatively by representatives from Cal-Am, the District, and CDFG, and is designed to balance water supply and environmental needs. Under Regulation X, a goal that "no more than 29 percent of Cal-Am's total annual water production be diverted from San Clemente Reservoir" is set.

The monthly distribution of surface water diversions from San Clemente Reservoir is governed not only by the District's quarterly review but also by the conditions specified in the MOA. The purpose of the MOA is to maximize surface flows in the Carmel River from San Clemente Dam to the Narrows from April 1 through November 30 for the benefit of juvenile steelhead, riparian vegetation, and other aquatic resources. In order to maximize streamflow below San Clemente Dam during this low flow period, it is necessary to minimize diversions from San Clemente Reservoir to the Carmel Valley Filter Plant and utilize stored water.

OPERATIONAL SCHEMATIC FOR NO PROJECT ALTERNATIVE FIGURE 4-20



SOURCE: MPWMD

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For the No Project alternative, specific operating rules governing diversions and releases from San Clemente Reservoir were developed and incorporated into CVSIM. The rules were based on recommendations from CDFG[26] and reflect the operations proposed in the Interim Relief Plan developed by the Environmental Advisory Committee.[27] The rules apply to both high and low flow periods during the year and are shown in Table 4-8. It should be noted that the fishery releases specified in the MOA are required at the Sleepy Hollow weir, one mile downstream of San Clemente Dam. No flows are required downstream of this site. During high flow periods, diversions from San Clemente Reservoir vary according to projected water supply conditions. During low flow periods, the maximum diversion allowed is seven acre-feet per day unless both Los Padres and San Clemente Reservoirs are spilling and flow in the Carmel River exceeds 10.0 cfs at the Sleepy Hollow weir.

The existing Los Padres Reservoir would be operated to maintain storage in San Clemente Reservoir. For the CVSIM simulations, a minimum release of 5.0 cfs would be maintained below Los Padres Reservoir. To insure that sufficient storage would be available to satisfy this release, a monthly target rule curve was specified for Los Padres Reservoir.

4.5.4 WATER SUPPLY PHASING AND YIELD

The phasing of yield from the No Project alternative would differ from the previous alternatives in that it is governed by the District's existing Water Allocation Program. Based on the 1990 Water Allocation Program EIR findings as well as information about the Paralta well yield, the Board determined in 1992 that the production limit for the Cal-Am system would be 17,359 AF once the Paralta well was operational. A system is in place to divide the additional 385 AF of production for new connections among the eight jurisdictions within the District. This additional supply should provide water for a limited amount of growth.

4.5.5 PROJECT TIMELINE

The No Project alternative entails production from the new Paralta well by mid-to-late 1993. No other facilities are anticipated in the near future.

4.6 OTHER PROJECT COMPONENTS

In addition to the project components that would be specific to each of the five alternatives described above, there are other project components that would be common to all of the alternatives. Each

TABLE 4-8

OPERATION SCHEDULE FOR SAN CLEMENTE RESERVOIR

High Flow Period: December 1 through March 31
Diversion Based on Expected Inflow to San Clemente Reservoir

Expected Inflow[1] (Water-Year Type)	Maximum Diversion (cfs)	Minimum Release (cfs)
Normal or Better	16.0	4.0
Below Normal	5.6	4.0
Dry or Critically-Dry	3.5	4.0

Low Flow Period: April 1 through November 30
Diversion Based on Observed Inflow to San Clemente Reservoir

Observed Inflow[2] (cfs)	Maximum Diversion (cfs)	Minimum Release (cfs)
Less than 1.0	0.0	0.0 - 1.0
1.1 to 5.0	0.0 - 1.0	1.1 - 4.0
5.1 to 7.5	1.1 - 3.5	4.0
7.6 to 13.5	3.5	4.1 - 10.0
13.6 to 26.0	3.6 - 16.0	10.0
Greater than 26.0	16.0	>10.0

1 Expected inflow refers to the water-year type that is expected at San Clemente Reservoir, given the inflow to date. These types – normal or better, below normal, and dry or critically-dry – are defined based on the 50.0, 75.0, and 87.5 percent exceedance frequencies, respectively.

2 Observed inflow refers to the inflow computed at San Clemente Reservoir. Under current practices, this inflow is based on measurements at the Sleepy Hollow low flow weir, which is one mile downstream of San Clemente Dam.

3 Diversions greater than 3.5 cfs are allowed only when both Los Padres and San Clemente Reservoirs are full and spilling.

Source: MPWMD

alternative, including the No Project, would entail the District's long-term conservation program, which includes wastewater reclamation and turf irrigation. Refer to Sections 2.5.2 and 2.5.3 for more information.

In addition to conservation and reclamation, the following Cal-Am facilities and programs may also occur in the future for some alternatives. They include:

- additional groundwater development in the Seaside Coastal Basin and the Carmel Valley aquifer,
- improvements to the Cal-Am distribution system, including a new water treatment plant in the lower Carmel Valley, and
- maintenance dredging programs at the existing Los Padres and San Clemente Reservoirs.

Only conceptual information on Cal-Am facilities that may be needed in the future is available. These facilities are mentioned here and included in this EIR/EIS to more accurately portray the future cost of water, with or without a long-term water project, and to ensure a valid comparison of project components and capabilities. The site-specific impacts of any new Cal-Am facility or program will be subject to the formal environmental review process by the appropriate agencies at the future point in time when they are proposed by Cal-Am.

4.6.1 GROUNDWATER DEVELOPMENT BY CAL-AM

As water demand by Cal-Am approaches buildout levels, it will be necessary to develop additional sources of supply other than those described for each alternative. These other sources are needed to provide production capacity during peak demand periods and during extended drought periods when reservoir storage is likely to be depleted. Based on a review of California Department of Health Services (DHS) requirements, Cal-Am has indicated that, in order to obtain an operating permit for any new or modified facility, the Company must demonstrate that the system's facilities are adequate to meet a calculated maximum day production requirement of 114.1 AF. This maximum day production value is based on a statistical evaluation of actual maximum day events over the last ten years and applies to a buildout demand of 22,750 AF per year.

Additional groundwater development is being considered by Cal-Am for the Seaside Coastal Basin and the Lower Carmel Valley Aquifer. Each of these possible developments is described below.

Seaside Coastal Groundwater Basins

For all alternatives, it was assumed that an additional 6.63 AF per day (AFD) of groundwater production capacity would be available in the Seaside Coastal Groundwater Basins. This additional capacity would equate to one new well in the Seaside area (the Paralta Well) with a capacity of 1,500 gallons per minute (gpm). Other well sites that are being explored by Cal-Am for development include the Seaside High School site, and the Plumas site.[28] A well developed at the High School site would be able to take advantage of between 1,000 and 2,000 AF of water that is estimated to be available each year in the Northern Seaside Coastal Basin. In addition, a well at the Plumas site would be able to take advantage of between 200 and 300 AF of water each year that is presently available in the Southern Seaside Basin. Additional water could be produced from Cal-Am's existing Playa No. 4 well in the Seaside Coastal Basin, if a suitable water treatment plant could be developed at a competitive cost. Cal-Am is presently conducting an isotope study to better quantify possible supply sources; thus, it would be speculative to include increased production capacity in this EIR/EIS.

Lower Carmel Valley Aquifer

In order for Cal-Am to meet maximum day demand at buildout, additional production sources will be needed. The amount of additional production capacity and the periods when it will be needed would vary with each alternative. For the 24 NLP, 24 NLP/D, and 15 CAN/D simulations, it was assumed that Cal-Am would reconstruct or replace three existing production wells in subunit 3 of the Carmel Valley aquifer (viz. San Carlos, Cypress, and Pearce) and develop a new well in subunit 4 to provide an additional 28 AF/day (AFD) of pumping capacity. The production capacity from the three existing wells would be increased from approximately 1,000 gpm to 2,500 gpm and the new pumping capacity in subunit 4 would total 2,000 gpm. For the 7 DSL and No Project simulations, no additional groundwater production capacity in the Carmel Valley aquifer was assumed.

4.6.2 CAL-AM WATER DISTRIBUTION IMPROVEMENTS

Cal-Am has maintained that evaluation of any water supply project should identify associated treatment facility, distribution, storage and transmission improvements that would be necessary to assure reliable water service in the future.[29] In this EIR/EIS, this information is used primarily for economic comparisons of projects, as discussed in Section 4.8. It also relates to potential environmental impacts, operational considerations and effects on public services that would be evaluated when specific projects are proposed.

A key element among the proposed system improvements is a new water treatment plant (WTP) in the Lower Carmel Valley. With the 15 CAN/D alternative, a WTP with a capacity of 38 AF per day would be necessary (1) to meet normal-year demands from Cañada Reservoir and (2) to treat groundwater in excess of the Begonia WTP capacity for maximum day events when Cañada reservoir is depleted. The Cañada WTP plant would need to be constructed at the same time as the other facilities for the 15 CAN/D alternative.

The 24 NLP alternative would require construction of a Lower Carmel Valley WTP with a 18.0 acre-foot per day capacity to meet maximum day demands at the projected buildout demand. This capacity would be needed to treat groundwater from the Lower Carmel Valley when surface water storage is depleted. Similarly, the 24 NLP/D alternative would require construction of a WTP with a 10.0 acre-foot per day capacity. No additional treatment capacity would be required for the 7 DSL or No Project alternatives.

4.6.3 MAINTENANCE DREDGING BY CAL-AM

Over time, both San Clemente and Los Padres Reservoirs have lost storage capacity due to sedimentation. Since 1921, when San Clemente Dam was completed, storage capacity in San Clemente reservoir has been reduced by 63 percent, to a current level of 800 AF of total storage. Similarly, since 1949, storage capacity in Los Padres Reservoir has been reduced by 32 percent to a current level of 2,180 AF of total storage. Altogether, reservoir storage in the Carmel River Basin has decreased by more than 50 percent of original capacity and currently totals less than 3,000 AF.

At the current sedimentation rate, assuming average annual conditions with the flashboards lowered, San Clemente Reservoir would be at zero capacity within twenty years. Similarly, within 40 years, storage in Los Padres Reservoir would be reduced to the point that Cal-Am would be unable to provide the 5 cfs minimum flow below Los Padres Dam that is stipulated in its water rights permit.

To forestall this reservoir sedimentation and associated consequences, Cal-Am has indicated that maintenance dredging programs would be initiated at some future date at both San Clemente and Los Padres Reservoirs, but no specific proposal has been formulated.[30] For CVSIM modeling purposes, the District assumes that storage at San Clemente Reservoir would be maintained at its current levels, i.e. 320 AF with the flashboards lowered and 800 AF with the flashboards raised. Similarly, usable storage at San Clemente Reservoir would be maintained at 130 AF with the

flashboards lowered and 610 AF with the flashboards raised. Storage at Los Padres Reservoir would be maintained at 1,712 AF of total storage or 1,500 AF of usable storage.

It should be noted that the actual sedimentation rates will vary over time depending on inflow and land use conditions in the upper watershed. In CVSIM, it was assumed that the reservoir capacities would be maintained each year at the prescribed levels. In actual practice, it is likely that the maintenance dredging programs will be operated more periodically in response to specific events.

For the EIR/EIS analyses, all of the alternatives (except the New Los Padres alternatives) assumed a maintenance dredging program at Los Padres Reservoir. Likewise, all of the alternatives assumed a maintenance dredging program at San Clemente Reservoir.

Existing San Clemente Dam. The California Department of Water Resources, Division of Safety of Dams (DSOD) has determined that there are structural deficiencies with San Clemente Dam, constructed in 1921. DSOD concerns are related to seismic stability (due to more stringent standards), overtopping and foundation erosion in a Probable Maximum Flood event, and operation of 24 gates at the dam crest.

Cal-Am has developed a Structural Improvements Plan to address these concerns. The Plan entails (1) exploration of alternative solutions and selection of the preferred alternative in accordance with CEQA; (2) project design and permit acquisition; and (3) construction. Alternative concepts presently being explored include breaching or lowering the dam, strengthening the existing dam, or strengthening and raising the dam (possibly combined with dredging).

The MPWMD has assisted Cal-Am by using the CVSIM model to analyze the water supply impacts of several alternative treatments of San Clemente Dam. The environmental review process (and EIR) has not been initiated, and it is unknown when the preferred alternative will be selected.

4.7 CONTINUATION OF EXISTING PROGRAMS

All alternatives, including the No Project, would continue all of the following programs: water conservation, reclamation, and activities presently conducted under the Carmel River Management Program and the riparian vegetation irrigation program. Descriptions of these programs are found in Section 2.5, Actions Already Taken.

4.8 PROJECT COSTS

The estimated costs for each alternative in 1992 dollars are shown in Table 4-9. Capital costs for projects include the dam and/or desalination facilities, fish passage facilities, access roads, and land. Capital costs for mitigation measures would include equipment and materials for riparian revegetation and fisheries, as well as for off-site road improvements. In addition, there would be capital costs for anticipated improvements to the Cal-Am system that would be needed for each alternative, as described in Section 4.6. These improvemer ts do not include potentially substantial costs for Cal-Am facilities that will be required to meet recent amendments to federal water quality regulations.

As shown in Table 4-9, estimated total capital costs in 1992 dollars range from $4.8 million for the No Project alternative to nearly $184 million for the 15 CAN/D alternative.

The average annual operation and maintenance (O&M) cost estimates are also provided in Table 4-9. O&M costs include labor, materials, supplies, power, and other associated costs for the operation and maintenance of the project. Similar to the capital costs described above, the O&M estimates also include annual costs associated with various mitigation programs as well as the Cal-Am system improvements needed for each alternative. In 1992 dollars, the estimated O&M costs range from $1.3 million per year for the No Project alternative to $7.7 million per year for the 7 MGD Desalination alternative. The annual O&M costs for alternatives, especially those that entail desalination, would be higher in drought years compared to average years. The difference is due to an increase in production from the desalination plants, and from higher groundwater pumping and mitigation requirements. Conversely, O&M costs would be lower than the average costs shown in Table 4-9 in wetter than normal years.

Table 4-10 is a summary of capital and O&M costs projected into the future to years in which they would be incurred. Capital costs are projected forward to the mid-point of construction, and O&M costs are projected to the first year of operation of a given project component. Varying rates of cost escalation are used, depending on the category of costs. For capital costs, all costs are increased at a rate of four percent (4%) per year, except for dam construction costs, which are escalated at three percent (3%) per year. The O&M costs are generally increased at a rate of 4.5 percent per year. Energy costs, however, are escalated at 5.2 percent per year. The various escalation rates were determined based on long-term cost trends for construction, operating and maintaining corresponding project components.

TABLE 4-9

SUMMARY OF PROJECT COSTS
(1992 COSTS IN $ THOUSANDS)

Item	24 NLP	24 NLP/D	15 CAN/D	7 DSL	NO PRJ
Capital Costs					
Dam and Appurtenances	$73,805	$73,805	$131,234	$ 0	$ 0
Desalination Facilities					
3 MGD Plant	0	29,592	29,592	29,592	0
4 MGD Plant	0	0	0	47,851	0
Mitigation Facilities[1]	3,011	3,011	1,013	0	0
MPWMD Costs	76,815	106,407	161,838	77,443	0
Cal-Am System Improvements[2]	15,498	13,514	22,572	8,896	4,833
Total Capital Costs	$92,313	$119,921	$184,410	$86,339	$4,833
O&M Costs[3]					
Dam and Appurtenances	$ 622	$ 622	$ 432	$ 0	$ 0
Desalination Facilities					
3 MGD Plant	0	2,509	2,509	2,509	0
4 MGD Plant	0	0	0	4,009	0
Mitigation Facilities[1]	244	230	210	464	471
MPWMD Costs	866	3,361	3,151	6,982	471
Cal-Am System Improvements[2]	677	551	1,682	677	803
Total O&M Costs	$1,543	$3,912	$4,833	$7,659	$1,274

1 Mitigation costs include riparian vegetation, fisheries and off-site road improvements.

2 Costs include improvements to the Cal-Am system: water treatment plant, pipelines, booster stations, tanks and new wells needed with each alternative to meet future demand. Cal-Am improvements do not include additional facilities needed to meet recent amendments to federal water quality regulations.

3 O&M costs include labor, materials, supplies, power, and other associated costs for the operation and maintenance of the project.

Source: MPWMD

TABLE 4-10

SUMMARY OF PROJECT COSTS AT PROJECTED TIME OF CONSTRUCTION/FIRST YEAR OF OPERATION[1] (FUTURE COSTS IN $ THOUSANDS)

Item	Activity Date	24 NLP	24 NLP/D	15 CAN/D	7 DSL	NO PRJ
Capital Costs						
Dam and Appurtenances	2000	$95,859	$95,859	$168,732	$ 0	$ 0
Desalination Facilities						
3 MGD Plant	1994	0	32,018	32,018	32,018	0
4 MGD Plant	2000	0	0	0	65,507	0
Mitigation Facilities[2]	2000	4,122	4,122	1,385	0	0
Cal-Am System Improvements[3]						
Phase I	1994	0	4,440	4,440	4,440	0
Phase II	2000	21,210	12,878	25,274	6,561	6,614
O&M Costs[4]						
Dam and Appurtenances	2002	966	966	703	0	0
Desalination Facilities						
3 MGD Plant	1995	0	2,888	2,888	2,888	0
4 MGD Plant	2002	0	0	0	6,438	0
Mitigation Facilities[2]	2002	380	357	326	720	732
Cal-Am System Improvements[3]						
Phase I	1995	143	143	286	286	286
Phase II	2002	877	673	2,300	673	877

1 Costs in this table are not additive for a given project since they do not have a common time basis. The 1992 costs in Table 4-9 were projected forward to the years in which they would be incurred.

2 Mitigation costs include riparian vegetation, fisheries and off-site road improvements.

3 Costs include improvements to the Cal-Am system: water treatment plant, pipelines, booster stations, tanks and new wells needed with each alternative to meet future demand. Cal-Am improvements do not include additional facilities needed to meet recent amendments to federal water quality regulations.

4 O&M costs include labor, materials, supplies, power, and other associated costs for the operation and maintenance of the project.

Source: MPWMD

Costs in Table 4-10 are not added together since they do not have a common time basis. A detailed analysis of the time series of costs for each alternative was made as part of the determination of the average costs to residential water users, which is discussed in Chapter 18, Socioeconomics.

One way that total project costs may be compared is by determining the present worth of estimated future costs. This was done for each alternative for the period from 1994, when the earliest project costs would be incurred, the present through year 2020; the results are presented in Table 4-11. Capital costs in this table include the cost of bond financing and interest during construction. The O&M costs are the sum of all annual costs for O&M through year 2020.

All costs were converted to their 1992 value using a present worth computation at five percent (5%) per year. Total present worth costs range from $32.8 million for the No Project alternative to $282.5 million for the 15 CAN/D alternative. The costs shown in Table 4-11 for projects that combine a dam with a desalination plant (24 NLP/D and 15 CAN/D) assume construction of the desalination component first, followed by the dam component. These cost estimates do not include significant expenditures by Cal-Am for facilities that are likely to be needed to meet recent amendments to *federal water quality regulations.*

4.9 REGULATORY AGENCY APPROVAL

A number of public agencies will refer to this document during the permitting process. The following permits would likely be required prior to the start of project construction.

4.9.1 FEDERAL AGENCIES

4.9.1.1 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (COE) is the lead Federal agency for the preparation of this document. The COE exercises final permit authority over the proposed project under the Federal River and Harbor Act of 1899, the Federal Water Pollution Control Act of 1972 as amended (the Clean Water Act, 1977), and related statutes described below. COE permit regulations (33 CFR 320-329) require an evaluation of the extent to which a proposed permit activity is in the public interest. This is the most important criterion applied in the decision to issue a permit. For any permit application, the COE must consider all applicable official State, regional, or local land use plans and/or policies as reflecting local factors of the public interest (33 CFR 320.4[j][2]); thus the COE

TABLE 4-11

PRESENT WORTH OF ESTIMATED PROJECT COSTS THROUGH YEAR 2000[1]
(COSTS IN 1992 $ THOUSANDS)

	24 NLP	24 NLP/D	15 CAN/D	7 DSL	NO PRJ
MPWMD Capital	$71,556	$102,456	$152,971	$77,640	$ 0
MPWMD O&M	15,046	78,219	75,257	145,703	8,812
Total MPWMD[2]	86,602	180,675	228,228	223,343	8,182
Cal-Am Capital	15,274	13,557	22,485	9,007	4,763
Cal-Am O&M	13,047	10,671	31,764	13,698	19,902
Total Cal-Am[3]	28,321	24,228	54,249	22,705	24,665
Total Present Worth	$114,923	$204,903	$282,477	$246,048	$32,847

[1] Present worth of estimated future project costs for the period 1994 through 2020. Future costs were converted to their 1992 value using a present worth computation at 5 percent per year. For combination projects (24 NLP/D, 15 CAN/D), costs assume construction of desalination component in year 1994, with first year of operation in 1995, followed by construction of dam in 1999-2001, with first year of operation in 2002.

[2] MPWMD costs include capital and O&M costs for constructing and operating project facilities and mitigations.

[3] Cal-Am costs include capital and O&M costs for improvements to the Cal-Am system: water treatment plant, pipelines, booster stations, tanks, and new wells needed with each alternative to meet future demand. Costs for Cal-Am improvements do not include additional facilities needed to meet recent amendments to federal water quality regulations.

Source: MPWMD

will request review of permit applications in the study area by local governments. In addition, the COE is required by permit regulations to coordinate and consult with certain federal and State agencies (33 CFR 320.4) so that permit decisions will reflect factors of both national and statewide public interest. The following pertinent regulations will be considered by the COE prior to issuance of a permit for the project.

Clean Water Act. The Federal Water Pollution Control Act of 1971 (FWPCA), amended as the Clean Water Act (CWA) in 1977, was enacted to restore and maintain the physical, chemical, and biological integrity of the nation's waters. The CWA established a number of goals, requirements, prohibitions, and programs to achieve that purpose and addressed the problems of water pollution by using many different approaches. Section 404 of the Act establishes a permit program, administered by the COE, to regulate the discharge of dredged and fill material into "waters of the United States." Jurisdiction over "waters of the United States" extends to the high tide line of tidal waters, plus "adjacent" or "neighboring" wetlands. Applications for a Section 404 permit are evaluated according to 404(b)(1) guidelines set forth by the Environmental Protection Agency which give specific requirements for the use of disposal sites for dredged or fill materials. These regulatory guidelines (40 CFR Part 230) prohibit "the discharge of dredged or fill material if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other adverse environmental consequences."

The proposed action includes structural fill for foundations in waters and wetlands which are considered to be within the jurisdiction of the COE; therefore, a 404 permit will be required.

The 404(b)(1) guidelines require that for non-water dependent activities, the applicant must demonstrate that there are no practicable alternatives to the proposed fill activity (EPA 40 CFR 230.12[a][3]). To meet this requirement, the Monterey Peninsula Water Management District has prepared a 404(b)(1) analysis which is on file in the COE office (see also Section 3.6 and Section 20.2).

River and Harbor Act of 1899. Section 10 of the River and Harbor Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable waters of the United States. The construction of any structure in or over any navigable water, excavation or deposit of material in such waters, and various types of work performed in such waters, including fill and stream channelization, are examples

of activities requiring a COE permit. For alternatives that entail desalination, a portion of the project site may be within the COE Section 10 jurisdiction; therefore, a Section 10 permit may be required.

Fish and Wildlife Coordination Act. This Act requires the COE to consult with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the California Department of Fish and Game during preparation of an environmental study prior to issuance of a COE permit. Formal consultation with these agencies will occur through their review of the COE public notice and this Supplemental Draft EIR/EIS-II. The COE regulatory program requires the District Engineer to give full consideration to the views of these agencies in evaluating a permit application.

Endangered Species Act. This Act was passed in 1973 to provide protection for animal and plant species that are currently in danger of extinction ("endangered") and those that may become so in the foreseeable future ("threatened"). Section 7 of this Act requires federal agencies to ensure that their actions do not have adverse impacts on the continued existence of threatened or endangered species or in the designated areas (critical habitats) that are important in conserving those species. The U.S. Fish and Wildlife Service (USFWS) maintains current lists of species which have been designated as threatened or endangered.

The USFWS has provided the permit applicant with species lists in 1986, 1989, and most recently in 1991. An updated 1993 species list has been requested from the USFWS. The Vegetation and Terrestrial Wildlife chapter (Chapter 9, paragraph 9.1.3) describes the potential impacts of the project alternatives on various species. As required by Section 7(c) of the Act, the COE's biological assessment of potential endangered species impacts, as contained in this Supplemental Draft EIR/EIS-II, will be submitted to the USFWS Endangered Species Office for consultation.

National Historic Preservation Act of 1966, As Amended, and Executive Order 11593. This Act established the National Register of Historic Places and required the COE to consider the impacts of proposed activities on properties included in the National Register. Executive Order 11593 requires the COE, when considering issuance of a permit, to identify in consultation with the State Historic Preservation Office, any property potentially affected by the proposed action which is eligible for listing in the National Register. Reference Chapter 14 for a discussion of project area cultural resources.

Executive Order 11988, Floodplain Management (May 24, 1977). In order to reduce the risk to human safety, health, welfare, and property associated with floods and in order to preserve the natural and beneficial values served by floodplains, Federal agencies are directed by this order to evaluate the potential effects of actions (including the issuance of permits) taken in floodplains. This Supplemental Draft EIR/EIS-II evaluates these effects, including the effects of practicable alternatives as required by the Order.

Coastal Zone Management Act of 1972. Section 307(c) of this Act, as amended, prohibits the COE from issuing a permit in a coastal zone unless the permit applicant has furnished certification that the proposed activity complies with and will be conducted in a manner that is consistent with the approved Coastal Zone Management Program. The Coastal Zone Management Act requires any proposed activity requiring a Federal permit to be consistent with the State's program if it directly affects land or water uses within the coastal zone.

Executive Order 11990, Protection of Wetlands (May 24, 1977). This Order reiterates the need to preserve and protect wetlands as a national policy; however, it does not apply to the issuance of COE permits for activities by private parties in wetlands on non-federal property and is, therefore, not applicable to the proposed project.

4.9.1.2 U.S. Fish and Wildlife Service

The USFWS is responsible for the Federal interest in conservation, enhancement, and protection of fish and wildlife habitat and resources. Under the Fish and Wildlife Coordination Act (16 USC 661-666c), any Federal agency proposing to modify or control any body of water must first consult with the USFWS; thus, this Act provides the basic authority under which USFWS reviews COE permit applications. However, the USFWS is a nonregulatory agency with no permit granting authority.

4.9.1.3 U.S. Environmental Protection Agency (EPA)

The EPA is responsible for the administration of the Federal Water Pollution Control Act (PL 92-500) and its Amendments (FWPCA). (See the Clean Water Act above.) In general, EPA evaluates all COE permit applications to determine the possible impacts on water quality, air quality, toxic substances, and radiation.

4.9.2 STATE AGENCIES

4.9.2.1 California State Water Resources Control Board, Division of Water Rights

The State Water Resources Control Board (SWRCB) is a quasi-judicial body that administers water rights within California. The District must obtain a Permit to Appropriate Water in order to allow the diversion of water from the Carmel River. The SWRCB established the right of the applicant to use water, and the priority of that right. In addition, the SWRCB is concerned that permittees prevent waste, practice water conservation, and use the water to the fullest beneficial use.

The SWRCB held two sets of hearings pertinent to use of water within the Carmel River Basin in 1992. The first set of hearings, held in August/September 1992, considered complaints filed against Cal-Am, alleging that Cal-Am is illegally diverting underflow of the Carmel River without a permit, and that Cal-Am pumping results in unacceptable environmental damage to the Carmel River. The second set of hearings, held in October 1992, concerned the MPWMD's water rights application for the 24,000 AF New Los Padres Project.

Issues considered at the complaint hearings included hydrology of the Carmel River (underflow or percolating groundwater), Cal-Am's right to divert water, instream flows necessary to protect the steelhead resource, and impacts of Cal-Am diversions on public trust resources. Issues considered at the New Los Padres Project hearings included water availability, project impacts to existing users, time extensions for existing MPWMD permits, project impacts to public trust resources, instream flows needed, and impacts to cultural resources.

Extensive written and oral testimony was presented by the District, Cal-Am, complaints and protestants to the New Los Padres Project at these two hearings. Notably, 28 of the approximately 40 protestants to the New Los Padres Project signed dismissal agreements and endorsed the project. SWRCB staff has indicated that the SWRCB may issue an order regarding the complaints in Spring 1993; a decision on the New Los Padres Project would not be made until the Final EIR/EIS is certified (Fall 1993).

4.9.2.2 California Regional Water Quality Control Board

The California Regional Water Quality Control Board (RWQCB) for the Central Coast area reviews activities that affect water quality. Water quality standards for individual projects are established by

the RWQCB as part of the National Pollutant Discharge Elimination System (NPDES) permit procedure. Federal guidelines for fill permits prohibit placement of any fill if it causes or contributes to violations to any applicable State water quality standard, as determined by the RWQCB. The permitting process for Water Quality Certification would occur after the conclusion of the EIR/EIS process, and prior to the issuance of a COE permit.

4.9.2.3 State Department of Fish and Game (CDFG)

The CDFG, a division of the State Resources Agency, is charged with protecting and conserving the State's fish and wildlife resources including their supporting habitats and ecosystems. The CDFG implements the January 9, 1987 policies for wetland resource protection as stated in Chapter 2, of Part 3, Section 660, Title 14 of the California Administrative Code, regarding the role of CDFG in the "restoration, protection, preservation, enhancement and expansion of wetland habitat in California." The criteria is described for adequate compensation of wetlands losses for those projects for which it can be demonstrated that there is "no feasible, less environmentally damaging alternative location or design for the type of project being considered within a wetland." The test for adequate compensation "is that the project or action does not result in either a net decrease in the wetland acreage nor a net decrease in the wetland habitat values, which existed prior to project implementation."

Regulations of the CDFG are in the Fish and Game Code (CDFG, 1975 and 1976). CDFG has regulatory authority over harvest of fish and game and the taking of wildlife. It also issues stream alteration agreements for any activity which will alter the natural state of any river, stream, or lake.

Although the CDFG does not issue permits for development projects directly, its advice is part of the permit application and decision making processes of the COE, the final permitting agency. Its contributory role in the COE permit processes is established by the U.S. Fish and Wildlife Coordination Act, the Wetland Resources Policies for Resource Protection, and COE regulations. The CDFG also functions as a consultant to the SWRCB regarding water rights permit applications.

4.9.2.4 State Historic Preservation Office (SHPO)

The SHPO functions as the State component to carry out the National Historic Preservation Act and to ensure that the historic aspects of projects are in compliance with the California Environmental

Quality Act. The SHPO reviews private projects and COE permit applications for protection and preservation of historic resources. The agency reviews sites for eligibility for the National Register.

4.9.2.5 California Department of Water Resources, Division of Safety of Dams

The Division of Safety of Dams (DSOD) is responsible for the licensing and approval of dams within California to ensure that public safety is protected. The plans and specifications for any new dam would be subject to review and approval by the DSOD. In addition, the completed structure would be subject to periodic inspection by the DSOD.

4.9.2.6 California Department of Transportation (Caltrans)

The transport of oversized equipment to and from the construction site would require a Transportation Permit from Caltrans.

4.9.2.7 California Occupational Safety and Health Association (CAL OSHA)

The District would need to obtain a Permit for Construction from Cal OSHA for each of the proposed dams.

4.9.3 COUNTY OF MONTEREY

The transport of oversized equipment to and from the construction site would require a Transportation Permit from the County. In addition, County building and grading and use permits would also be required.

4.9.4 OTHER AGENCIES AND PERMITS

Depending on the method of clearing and grubbing for the proposed reservoirs, an approved Timber Harvest Plan may be required from the California Department of Forestry. If the burning of brush and scrub within the proposed reservoir inundation areas were to occur, a permit would be required from the Monterey Bay Unified Air Pollution Control District.

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1. Bechtel Civil, Inc., Monterey Peninsula Water Supply Project, New Los Padres, New San Clemente and San Clemente Creek Projects, Preliminary Designs and Cost Estimates, June 1989.

2. Bestor Engineers, Inc. March 1992. Based on aerial photographs flown on November 4, 1991.

3. Bechtel Civil, Inc., June 1989, op. cit.

4. U.S. Army Corps of Engineers, Feasibility Report on Water Resources Development, Carmel River, Monterey County, California (Draft), May 1981.

5. Monterey Peninsula Water Management District, Planning Memorandum No. 90-1, Reservoir Clearing and Grubbing for the New Los Padres Project, Prepared by Bruce Laclergue, June 1990.

6. Bechtel Corporation, Monterey Peninsula Water Supply Project, New Los Padres Dam Geotechnical Studies, June 1992.

7. California Department of Fish and Game, Letter from Randal C Benthin, Associate Fishery Biologist, Region 3, to Larry Foy, Vice President and Manager, California-American Water Company regarding Instream Flow Requirements to Evaluate the Proposed Canada Reservoir, March 21, 1989.

8. California Department of Fish and Game, Letter from Randal C. Benthin, Associate Fishery Biologist, Region 3, to Gerry Haas, Operations Manager, California-American Water Company regarding Clarification of Recommended Flows for the Purpose of Modeling the Canada Reservoir, June 16, 1989.

9. California Department of Fish and Game, Attachment to Letter from Pete Bontadelli, Special Assistant to the Director, to Bruce Buel, General Manager. Monterey Peninsula Water Management District regarding Alternative Water Management Programs for the Carmel River, February 28, 1986.

10. Monterey Peninsula Water Management District, Letter and Draft Technical Memorandum from David D. Dettman, Fisheries Biologist, to Randal C. Benthin, Associate Fishery Biologist, California Department of Fish and Game, regarding Streamflow Recommendations for Upstream Migration in the Carmel River below Schulte Road, October 26, 1989.

11. Meeting with Randal C. Benthin, Associate Fishery Biologist, California Department of Fish and Game, and David Dettman and Darby Fuerst, Monterey Peninsula Water Management District, regarding Adaptation of and Modifications to Bypass Flow Recommendations, February 13, 1990.

12. California Department of Fish and Game, Letter from Randal C. Benthin, Associate Fishery Biologist, Region 3, to Henrietta Stern, Project Coordinator, Monterey Peninsula Water Management District, regarding Assumptions to be Used in the CVSIM Computer Model for the Canada Reservoir, July 31, 1989.

13. Summaries of Fishery Working Group Meetings, Reservoir Operations and Instream Flow Requirements, February 10, 1992, March 12, 1992, and April 1, 1992, Prepared by Darby Fuerst, Monterey Peninsula Water Management District.

14. California Department of Fish and Game, Letter from Pete Bontadelli, Director, to Henrietta Stern, Senior Project Coordinator, Monterey Peninsula Water Management District, providing comments on the August 1991 Supplemental Draft EIR/EIS for the Monterey Peninsula Water Supply Project, Comment No. 40-10, November 15, 1991.

15. Personal Communication, Gerry Haas, Operations Manager, California-American Water Company, Monterey.

16. Boyle Engineering Corporation, Monterey Peninsula Water Management District, Desalination Feasibility Study, July 17, 1991.

17. James M. Montgomery, Monterey Peninsula Water Management District, Desalination Preliminary Design, Final Report, March 1992.

18. EIP Associates. Near-Term Desalination Project EIR. Prepared for MPWMD, April 1992 (Draft) and December 1992 (Final).

19. A Ranney collector, a patented design by Leo Ranney, is a reinforced concrete caisson from the bottom of which screens (laterals) are projected horizontally like the spokes of a wheel. The caisson is used as a clear well from which water can be pumped.

20. Steve Lonhart, California-American Water Company, Monterey, personal communication, February 11, 1991.

21. CVSIM is the computer model of surface and groundwater resources within the MPWMD; please refer to Chapter 3 for more detail.

22. Brown and Caldwell, February 1990, Cañada Reservoir Project Phase 2 - Cost Effectiveness Analysis. Prepared for California-American Water Company, (Draft), February 1990.

23. James M. Montgomery Consulting Engineers, Inc., Letter from Charles Dougherty to Margo Nottenkamper, Monterey Peninsula Water Management District, regarding Refinement of Preliminary Design for 7 MGD Desalination Project, July 17, 1992.

24. As determined within the Letter of Intent between the MCWD and the MPWMD, executed on December 11, 1991.

25. Monterey Peninsula Water Management District, Rules and Regulations, April 1990.

26. California Department of Fish and Game, Letter from Brian Hunter, Regional Manager, Region 3, to Art Jarett, Public Utilities Commission, regarding Impact of Water Diversions from the Carmel River on Steelhead Trout, Riparian Vegetation, and other Aquatic Resources, July 13, 1988.

27. Environmental Advisory Committee, Interim Relief Plan. Prepared by Monterey Peninsula Water Management District, (Draft 2), August 25, 1988.

28. Staal, Gardner, and Dunne, Hydrogeologic Update - Seaside Coastal Ground Water Basins, August 1990. Prepared for MPWMD.

29. Brown and Caldwell, Cañada Reservoir Project Phase 2-Cost Effectiveness Analysis, February 1990. Prepared for California-American Water Company.

30. Monterey Peninsula Water Management District, Letter from Henrietta Stern, Senior Project Coordinator, to Gerry Haas, Operations Manager, California-American Water Company confirming modelling assumptions regarding maintenance dredging at San Clemente and Los Padres Reservoirs, October 2, 1989.

5. EVALUATION OF WATER SUPPLY PERFORMANCE

5. EVALUATION OF WATER SUPPLY PERFORMANCE

5.1 INTRODUCTION

Water supply for the greater Monterey Peninsula area is derived solely from local sources. The three primary sources of supply are: (1) surface water diverted from the Carmel River at San Clemente Dam, (2) groundwater pumped from the Carmel Valley alluvial aquifer, and (3) groundwater pumped from the Seaside Coastal Subbasin. These sources comprise the Monterey Peninsula Water Resources System (MPWRS) shown in Figure 5-1. (See Chapter 7, Hydrology, for a more complete description of the MPWRS.)

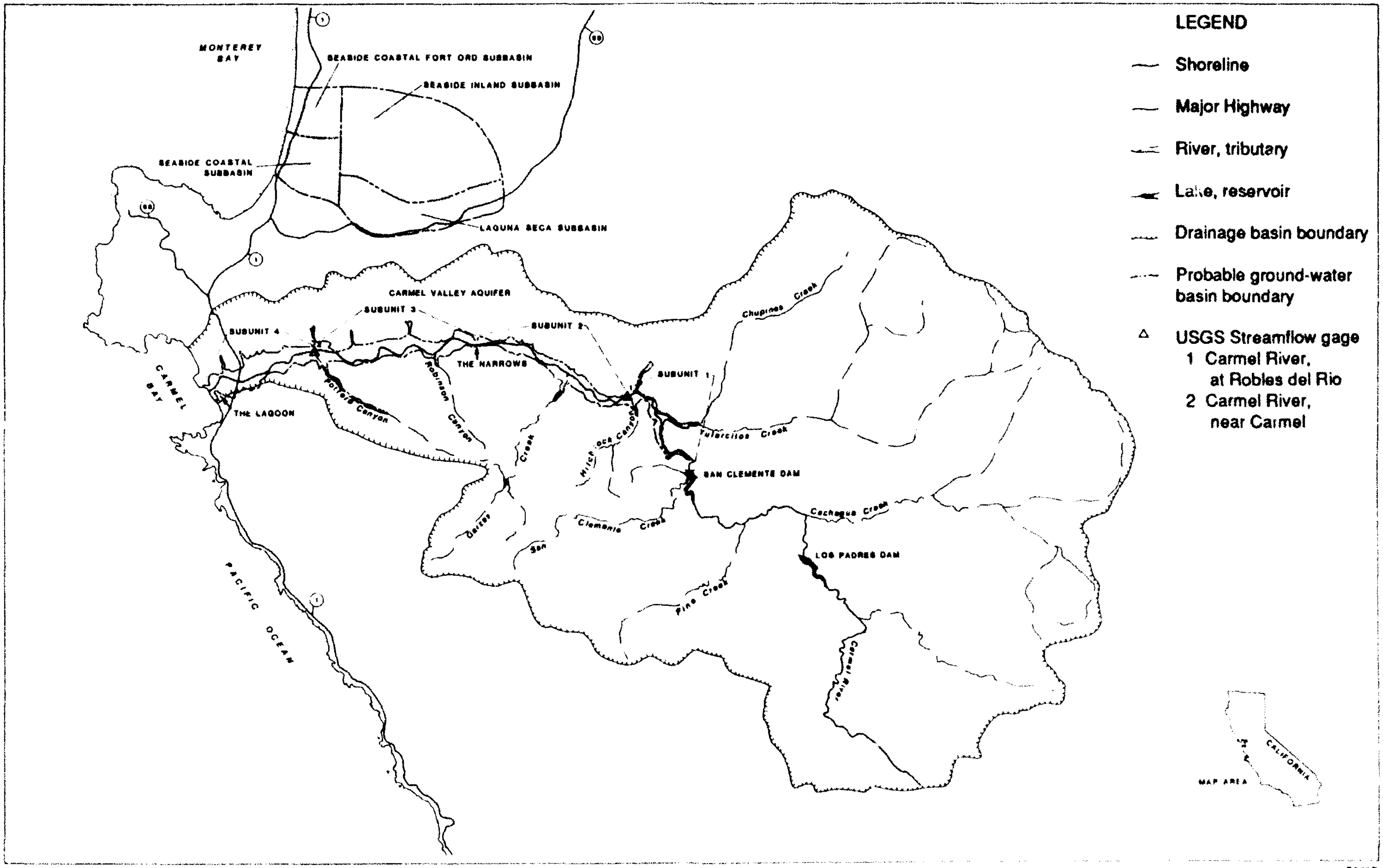
About 95 percent of the 105,000 residents within the MPWRS are served by the California-American Water Company (Cal-Am), an investor-owned public utility. Thus, much of this discussion focuses on the Cal-Am system. The remaining customers obtain their water from relatively small municipal or mutual water systems, or private (domestic, golf course or family farm) wells.

Two small dams owned by Cal-Am exist on the Carmel River. San Clemente Dam was built in 1921 with a total storage capacity of 2,140 acre-feet (AF). Los Padres Dam was built in 1948 with a total storage capacity of 3,030 AF. Over time, sedimentation has reduced the combined usable storage from these reservoirs to about 2,600 AF, or one-half of original capacity. The existing reservoir storage totals only 15 percent of the community's estimated normal year water demand (about 17,000 AF Cal-Am production in 1991).

The following paragraphs briefly describe those systems that extract water from the MPWRS. Non-municipal water uses, such as instream releases for fish, are addressed in Chapters 7 (Hydrology) and 8 (Fish and Other Aquatic Life).

MONTEREY PENINSULA WATER RESOURCES SYSTEM

FIGURE 5-1



SOURCE: MPWMD

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California-American Water Company: With about 36,000 customers, Cal-Am is the largest water purveyor within the MPWMD boundaries. With an annual production limit set at 16,744 AF (as of December 1990), Cal-Am supplies about 82 percent of the water managed by MPWMD (normal year data). Cal-Am draws from surface water in addition to wells in the Carmel Valley alluvial aquifer and the Seaside Coastal groundwater subbasin.

Prior to 1985, about 55 percent of Cal-Am production was derived from surface water diversions at San Clemente Dam. Under MPWMD Ordinance No. 19, which was passed in December 1984, a goal was set that no more than 35 percent of Cal-Am's annual production be derived from surface diversions at San Clemente Dam. Subsequent ordinances have reduced this maximum surface water diversion to 29 percent of total annual production and required that Cal-Am develop and comply with quarterly water supply budgets and strategies.

Seaside Municipal System: The City of Seaside operates the only publicly-owned water system within the MPWMD. The Seaside system has an assumed total annual production capacity of about 500 acre-feet.

Water West Corporation: Until 1989, the Del Monte Division of Water West Corporation (WWC) supplied customers in the Carmel Valley from four alluvial wells. The total annual production capacity of WWC is assumed to be about 500 AF. Cal-Am now owns WWC, but operates it as a separate distribution system for recording purposes to comply with the District's water allocation program.

Small Water Distribution Systems: In addition to the three systems described above, there are 23 small water distribution systems located within the District. These systems vary in size and serve from two to almost three hundred connections. Of the 23 systems, seven extract water from within the MPWRS and sixteen pump water from outside the MPWRS, primarily from non-alluvial aquifers.

Private Wells: Approximately 300 private wells are located within MPWMD boundaries. Most of these wells serve single-family homes, and are used to supply irrigation water for landscaping, gardens and fruit trees. However, some are relatively large wells that irrigate golf courses or small farms that are not within a water distribution system such as Cal-Am. The District administers an annual water

usage reporting program for private wells and is responsible for regulating these wells during water supply emergencies.

Table 5-1 lists the 1986-87 production levels for water distribution systems and private wells within the District boundaries and the source of supply for each system or group of wells. Data for reporting year 1986-87 are shown because it is the last year in which water usage was not affected by voluntary and mandatory conservation efforts that were implemented during the 1987-1992 drought period. Figure 5-2 shows the location of each of the water distribution systems within the District boundaries. Total production within the MPWRS in 1986-87 was approximately 20,950 AF – about 17,800 AF production from Cal-Am, and nearly 3,150 AF production from other mutual water companies and private wells. Production totaled about 750 AF outside of the MPWRS.

PRODUCTION TRENDS

Municipal water production in the Monterey Peninsula area has more than tripled since 1940, reflecting nearly a three-fold increase in population, economic growth and construction of several new golf courses since the mid-1960s. Weather patterns also affect water consumption. Cal-Am data indicate that unrationed water demand increases by about five percent in dry years and decreases by about eight percent in wet years.

As shown in Figure 5-3, Cal-Am production steadily increased until 1970, then leveled off through 1976. Mandatory water rationing imposed during 1977 resulted in a dramatic reduction in production. Production returned to pre-drought levels by 1980 and continued to climb until 1988. Production declined significantly again when mandatory rationing was imposed by MPWMD in January 1989 until May 1, 1991.

Since 1981, Cal-Am production has been limited to 20,000 AF annually (AFA) by the MPWMD Water Allocation Program. This production maximum was reduced to 16,744 AFA in December 1990, based on the findings of the Water Allocation Program Final EIR, which was certified on November 5, 1990. Based on the EIR findings, and that Cal-Am "normal year" use was estimated by the District at about 17,000 AFA in 1991, the District Board enacted a temporary moratorium on new water permits. The moratorium will be lifted and the Cal-Am production maximum will be evaluated and increased when new sources of water supply are developed.

TABLE 5-1

WATER DISTRIBUTION SYSTEM AND PRIVATE WELL PRODUCTION
Monterey Peninsula Water Management District
July 1, 1986, to June 30, 1987

System Name	1986-1987 Production (Acre-Feet)	Water Source	Map # (Figure 5-2)
Within the Monterey Peninsula Water Resources System			
Cal-Am	17,828.3	CR/AQ1-4/SS	1
Seaside Municipal	490.8	SS	3
Water West	264.1	AQ2	2
Los Robles Road	7.0	AQ2	8
Rancho San Carlos Road	6.1	AQ3	5
Saddle Mountain	5.1	AQ3	6
Carmel Valley Road	2.6	AQ2	7
Riverside Park	2.0	AQ3	9
Rancho Fiesta Road 1 and 2	0.2	AQ2	19
Private Wells in AQ1	104.9	AQ1	
Private Wells in AQ2	98.4	AQ2	
Private Wells in AQ3	776.4	AQ3	
Private Wells in AQ4	1,045.2	AQ4	
Private Wells in Seaside Subbasin	334.2	SS	
Subtotal	20,965.3		
Outside of the Monterey Peninsula Water Resources System			
Bishop Water Company	127.0	LS	23
Carmel Valley Mutual	82.9	LS	22
P&M Ranch	76.3	CVU	13
Prince's Camp	36.9	CA	14
Sleepy Hollow	22.3	CVU	4
Moro Mini	17.3	CVU	20
Rancho Fiesta Mutual	10.2	CVU	15
Jensen Mobile Home	9.0	CA	16
Cachagua Road I: Brannan	6.0	CA	18
Schulte Road	3.1	CVU	11
Los Ranchitos De Aguajito	2.4	P	25
Tao Woods Mutual	1.4	CVU	12
Nason Road	1.4	CA	21
Country Club Road	0.7	CVU	10
Cachagua Road II: Jones	0.0	CA	17
Ryan Ranch	0.0	RR	24
Private Wells in Cachagua	70.1	CA	
Private Wells in the Carmel Valley Upland	21.4	CVU	
Private Wells in Laguna Seca Area	255.7	LS	
Miscellaneous Private Wells	11.1	P	
Subtotal	755.2		
TOTAL	21,720.5		

TABLE 5-1 (Continued)

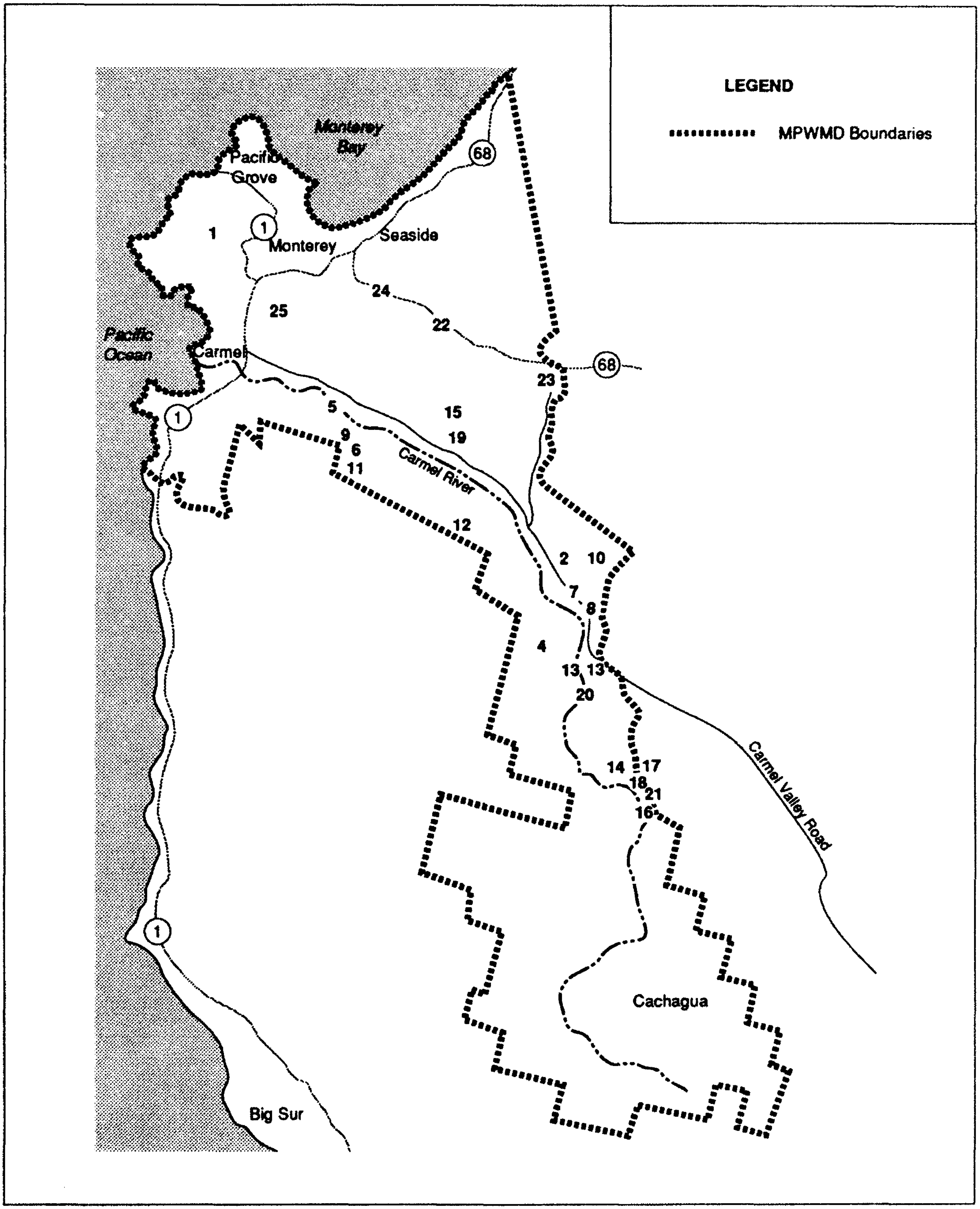
AQ1- San Clemente Dam to Esquiline Bridge
AQ2- Esquiline Bridge to the Narrows
AQ3- The Narrows to Via Mallorca Bridge
AQ4- Via Mallorca Bridge to the Ocean
CR- Diversion from Carmel River

CA- Cachagua Area
CVU- Carmel Valley Upland
LS- Laguna Seca Area
P- Peninsula
SS- Seaside Coastal Subbasin
RR- Ryan Ranch

Source: MPWMD 1986-87 Water Distribution System Report, August 1987; MPWMD 1986-87 Annual Well Reporting and Water Use Summary, August 1987.

WATER DISTRIBUTION SYSTEMS

FIGURE 5-2



SOURCE: MPWMD

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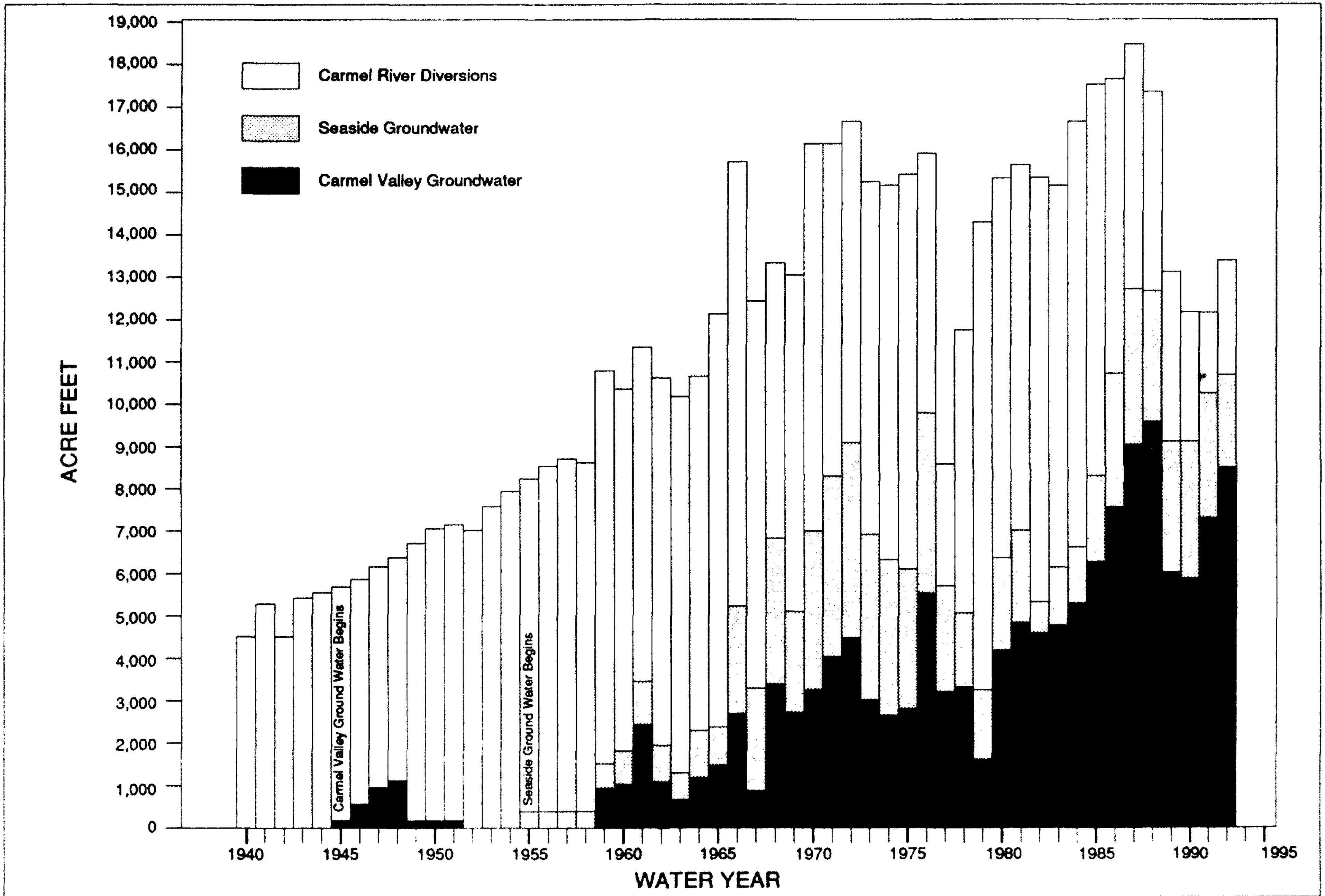
CAL-AM WATER PRODUCTION (1940-1992)

FIGURE 5-3



SOURCE: ARMY CORPS ENGINEERS (1981), MPWMD RECORDS

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DROUGHT VULNERABILITY

As documented in Chapter 2 (Need for a Water Supply Project), the Monterey Peninsula area depends on local rainfall to fill reservoirs and replenish the groundwater basins underlying Carmel Valley and Seaside. Rainfall varies significantly both seasonally and from year to year. The community's water supply is vulnerable to multiple-year droughts as evidenced by the 1976-77 and 1987-1992 events. In 1977, mandatory water rationing was imposed which restricted residential water use to 50 gallons per person per day. This action was considered necessary to bring daily demand and production capacity into balance and resulted in a reduction in demand of about 47 percent, as compared to unrationed demand in 1976. This mandatory program lasted for 11 months (February - December) in 1977. A 20 percent reduction in consumption was required by MPWMD from January 1989 to May 1, 1991 (28 months); voluntary 10-percent reductions and water waste prohibitions occurred before and after this period. Over the 90-year record, multi-year droughts (two or more consecutive dry or critically dry years) have occurred seven times, or once every 13 years on average. Two of these drought events lasted four or more consecutive years. Of the 90 years from 1902 to 1991, 27 years (30 percent) have been dry or critically dry. Twenty of the 27 years have been associated with multi-year droughts.

5.2 CVSIM MODEL AND ANALYTIC METHODS

The primary analytical method used to assess the water supply performance of the alternatives in this EIR/EIS is the Carmel Valley Simulation Model (CVSIM). CVSIM is a computerized mathematical simulation of surface-and groundwater resources within the District that was developed by District staff and consultants. A detailed description of CVSIM is found in Appendix 5. For the purposes of this chapter, it is sufficient to state that CVSIM simulates 90 years of water supply performance, based on a reconstructed daily streamflow record from 1902 through 1991. While it is recognized that this pattern will almost certainly not be repeated in the future, this record does provide a wide range of water availability conditions to assess the water supply performance of the various alternatives. The model is used to predict water supply performance with the implementation of new facilities (such as dams), different management schemes (including rationing), and increased water demands.

Each alternative was modeled based on the project descriptions found in Chapter 4. For each alternative except the No Project, future normal-year Cal-Am production is defined as 22,750 AFA. This represents the "buildout" demand, assuming 15 percent conservation, that is described in Chapter

2. ("Buildout" is defined as the maximum allowable growth according to the General Plans and other regulations for jurisdictions within MPWMD as of May 1992.) The normal-year Cal-Am production for the No Project alternative is 17,359 AFA, and represents the expected Water Allocation Program production limit in the year 1993.

It should be noted that all the CVSIM analyses in this Supplemental Draft EIR/EIS-II assume that water rationing at three different levels would be imposed by the District Board to avoid supply shortfalls in severe droughts. The three levels include 10 percent, 15 percent, and 25 percent reductions, which would be triggered by simulated differences in expected supply versus expected demand. Recall that 15 percent conservation is already assumed in the buildout demand.

5.3 INTERPRETATION OF RESULTS

The District has identified the basic purpose of the project as providing adequate water supply to meet the needs of planned growth, as well as drought protection for existing and future citizens. Thus, the analysis is focused on the water supply performance of each long-term alternative at the future point in time when buildout is achieved (Cal-Am normal-year production equals 22,750 AFA). The evaluation addresses the following questions of community concern:

1. Would a project provide adequate supply to meet future Cal-Am buildout demand, especially in droughts?

2. How often would supply fall short of demand and to what extent would rationing be needed with each alternative?

   The District Board determined that a project goal is to meet at least 90 percent of annual Cal-Am demand in any water year; this corresponds to no more than a 10 percent shortage. Using the three rationing levels described above in Section 5.2, this goal would mean avoiding mandatory rationing of a 15 percent or 25 percent reduction.

3. How much drought reserve (i.e., total usable system storage) would remain at the end of a dry period?

For the purpose of this general discussion, simulated annual shortages of less than 1,000 AF (4 percent shortfall) are not considered. The 1,000 AF amount was selected as a reasonable cutoff since the CVSIM model does not include water in Cal-Am's transmission lines or terminal storage, and therefore could be subject to some error. Also, it is assumed that 1,000 AFA or less could be successfully saved by voluntary conservation, if needed in the future.

This analysis of water supply performance focuses on simulations of the two most recent droughts – the 1976-77 event, which represents the most severe 27-month period on record, and the 1987-1992 event, which is now considered the most severe drought (combined duration and severity) of record. Because this analysis was performed in mid-1992, water year 1991 is the last year considered.

The following discussion is based on the specific project size and operations described in Chapter 4, which is encoded in the CVSIM computer code. It should be noted that changes in project size, or operations (even if the size remains the same), or other assumptions could result in different performance results. In simple terms, the performance results were obtained by superimposing the future buildout demand scenario and the reconstructed flow patterns on the water resource system. The results do not apply directly to actual water supply performance during the 1976-77 drought itself, nor to the 1987-1992 drought. Performance for each alternative would be substantially improved if current or near-term water demand was used instead of the higher buildout demand. Unless specifically noted otherwise, all years shown in this chapter refer to water years, which begin on October 1 and end on September 30 the following year, thereby overlapping two calendar years.

It should be noted that water supply performance of all long-term alternatives would be improved at demand levels lower than the 22,750 AFA buildout demand used in this analysis. For example, there would be no significant shortages for any long-term alternative at a Cal-Am demand of 20,000 AFA.

5.4 SUMMARY OF WATER SUPPLY PERFORMANCE

This section compares and contrasts the performance of the four long-term water supply alternatives analyzed by the District, and addresses the three questions posed in Section 5.3. Because the No Project cannot be compared directly to the long-term projects due to differences in demand, it is addressed separately.

The analysis in Table 5-2 indicates that the primary water supply benefit of any long-term project alternative is protection against critically dry years or sustained droughts. In "normal" (i.e., median) years, and even many individual "dry" years, adequate supply is available from the water resource system to meet the community's needs. For example, Table 5-2 indicates that there would be adequate supply in about 88 percent of the years simulated, even with No Project facilities, at a buildout demand level of 22,750 AFA Cal-Am production. However, whenever two or more sequential dry

TABLE 5-2

PERCENT OF ANNUAL CAL-AM DEMAND DELIVERED AT VARIOUS FREQUENCIES AT BUILDOUT[1]

Frequency	24 NLP	24 NLP/D	15 CAN/D	7 DSL	NO PRJ[3]
100% of years[2]	77%	88%	85%	98%	70%
95% of years	93%	100%	93%	100%	82%
87.5% of years	100%	100%	100%	100%	98%
75% of years	100%	100%	100%	100%	100%

[1] Buildout assumes a normal year demand of 22,750 AF Cal-Am production. This demand would be as high as 23,890 AF in a critically dry year.

[2] "Years" refers to the 90 simulated years, 1902 to 1991.

[3] For this table, No Project facilities were simulated at buildout demand.

Source: MPWMD

or critically dry years occur, shortages rapidly develop due to a lack of adequate storage and/or production facilities. The record in the past 90 years shows seven instances of multi-year droughts, some lasting four or more years.

If normal year Cal-Am demand reached buildout levels, estimated at 22,750 AF annual production, the project alternatives would provide varying levels of water supply benefits in droughts. It must be noted here that water supply performance for each alternative refers to the Cal-Am system performance, not the performance of a project alone. For example, water production from the 7 MGD desalination alternative must be combined with production from the two existing Carmel River dams, wells in Carmel Valley and wells in the Seaside Coastal basin in order to meet a demand of 22,750 AF. Alone, the 7 DSL could produce a maximum of about 7,000 AF annually.

5.4.1 24,000 AF NEW LOS PADRES PROJECT (24 NLP)

Tables 5-2 and 5-3 provide information on project yield at buildout demand. The "100% of years" row in Table 5-2 refers to the guaranteed performance (the percent of Cal-Am demand that would be provided in any year); this corresponds to the "firm yield" in Table 5-3. Firm yield is defined as

TABLE 5-3

FIRM YIELD AND PERCENT SHORTAGE OF LONG-TERM WATER SUPPLY ALTERNATIVES AT BUILDOUT[1]

Alternative	Firm[2] Yield (AF)	Percent Shortage in Worst Year
24 NLP	18,320	23%
24 NLP/D	21,020	12%
15 CAN/D	20,150	15%
7 DSL	22,760	2%

[1] Buildout assumes a normal year demand of 22,750 AF Cal-Am production. This demand would be as high as 23,890 AF in a critically dry year.

[2] Firm yield is defined as Cal-Am yield in the simulated year with the greatest shortage. Yield does not include instream releases, non Cal-Am yield or drought reserve in storage.

Source: MPWMD

the Cal-Am yield in the "worst year", when the project performs most poorly in terms of meeting municipal demand. It should be noted that firm yield does not include instream benefits or supply for non-Cal-Am production. The "95% of years" row in Table 5-2 refers to the performance expected in the fifth driest year in the 90 years that were simulated. The 87.5 percent and 75 percent frequencies refer to the "cutoff" points defining a "critically dry" and "dry" year, respectively.

As shown in Table 5-2, the 24 NLP alternative would meet the District "90 percent goal" in nearly all years at buildout demand levels. However, the 18,320 AF yield from the 24 NLP alternative in simulated water year 1990 corresponds to a 23 percent shortage in that year, which is greater than the desired maximum of a 10 percent shortage (Table 5-3). The 24 NLP alternative would also entail shortages between 11 and 17 percent in three other drought years. As shown in Figure 5-4, there would be 45 combined months of rationing in the 1977-78 and 1989-91 periods; 17 of those months would entail mandatory reductions of 25 percent, which would occur in the 1990-1991 period.

Table 5-4 indicates that the total usable system storage remaining at the end of the worst drought period (February 1991) would be 7,810 AF, which represents about 34 percent of normal year Cal-Am demand at buildout.

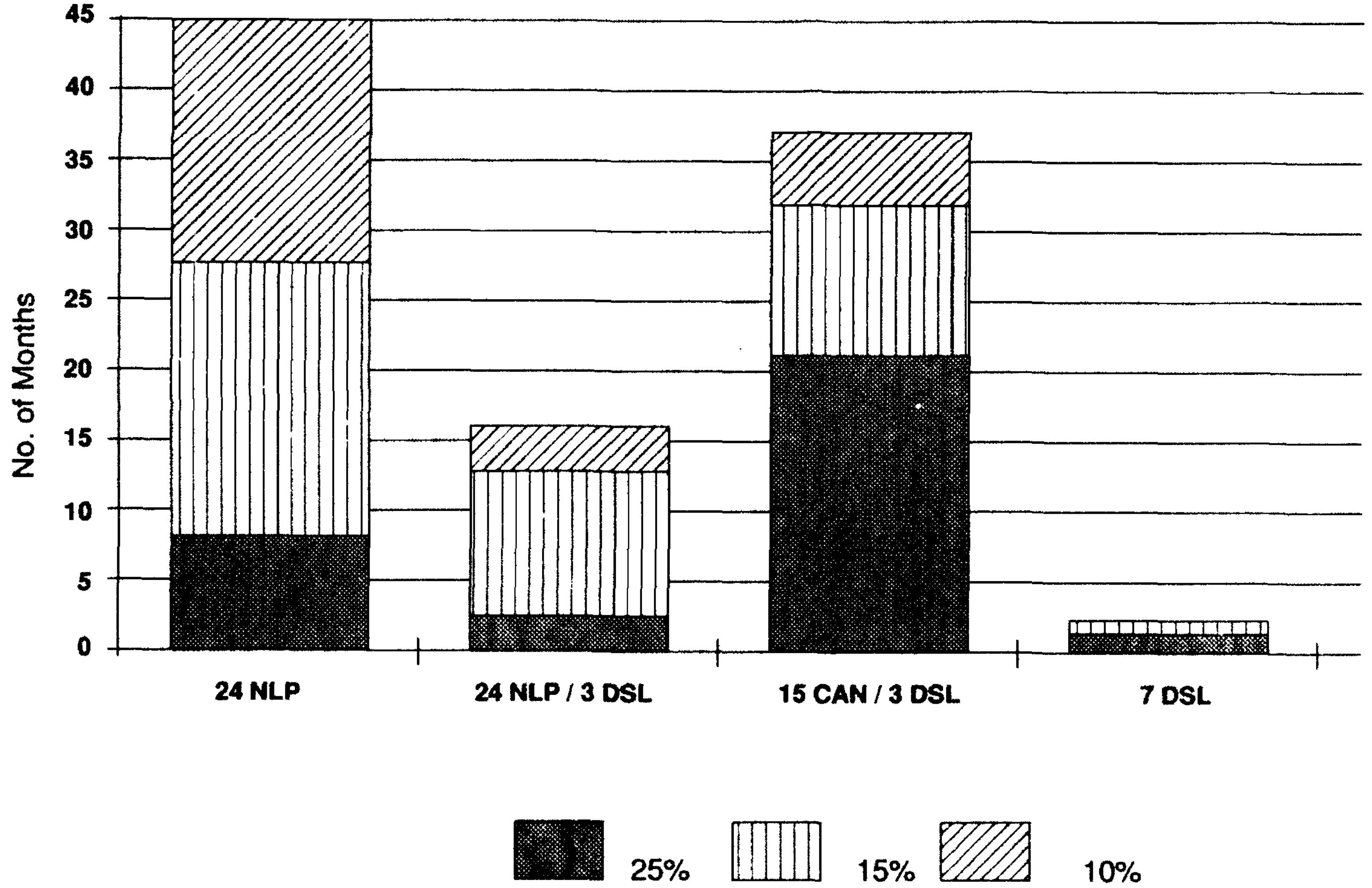
Assessment

The 24 NLP alternative would be able to meet the District Board's desired performance about 95 percent of the time at a buildout demand of 22,750 AFA. In order to attain the "90 percent goal" in all years, normal year Cal-Am demand would need to be reduced to about 20,500 AF per year with this alternative. Due to the substantial amount of water released from storage for instream benefits in dry years at the beginning of a drought (when the future cannot be predicted), water supply performance is impaired with the 24 NLP alternative by the third or fourth year of a severe multi-year drought.

As shown in Figure 5-5, the 24 NLP alternative at buildout demand would not provide the same level of drought protection as the No Project (existing) situation in simulated years 1989-91. This is due to the additional 5,400 AFA of demand that would occur at buildout compared to the No Project demand, as well as instream releases for fish of about 13,000 AF in simulated years 1987-88, which reduced storage in the reservoir.

SEVERITY OF RATIONING IN TWO DROUGHT EVENTS AT BUILDOUT
(1977-78 AND 1989-91 COMBINED)

FIGURE 5-4



SOURCE: MPWMD

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TABLE 5-4

USABLE SYSTEM STORAGE AT END OF WORST DROUGHT AT BUILDOUT[1]

Alternative	System[2] Storage (AF)	Percent[3] Annual Demand
24 NLP	7,810	34%
24 NLP/D	11,310	50%
15 CAN/D	10,710	47%
7 DSL	14,825	65%

[1] Buildout assumes a normal year demand of 22,750 AF Cal-Am production. This demand would be as high as 23,890 AF in a critically dry year.

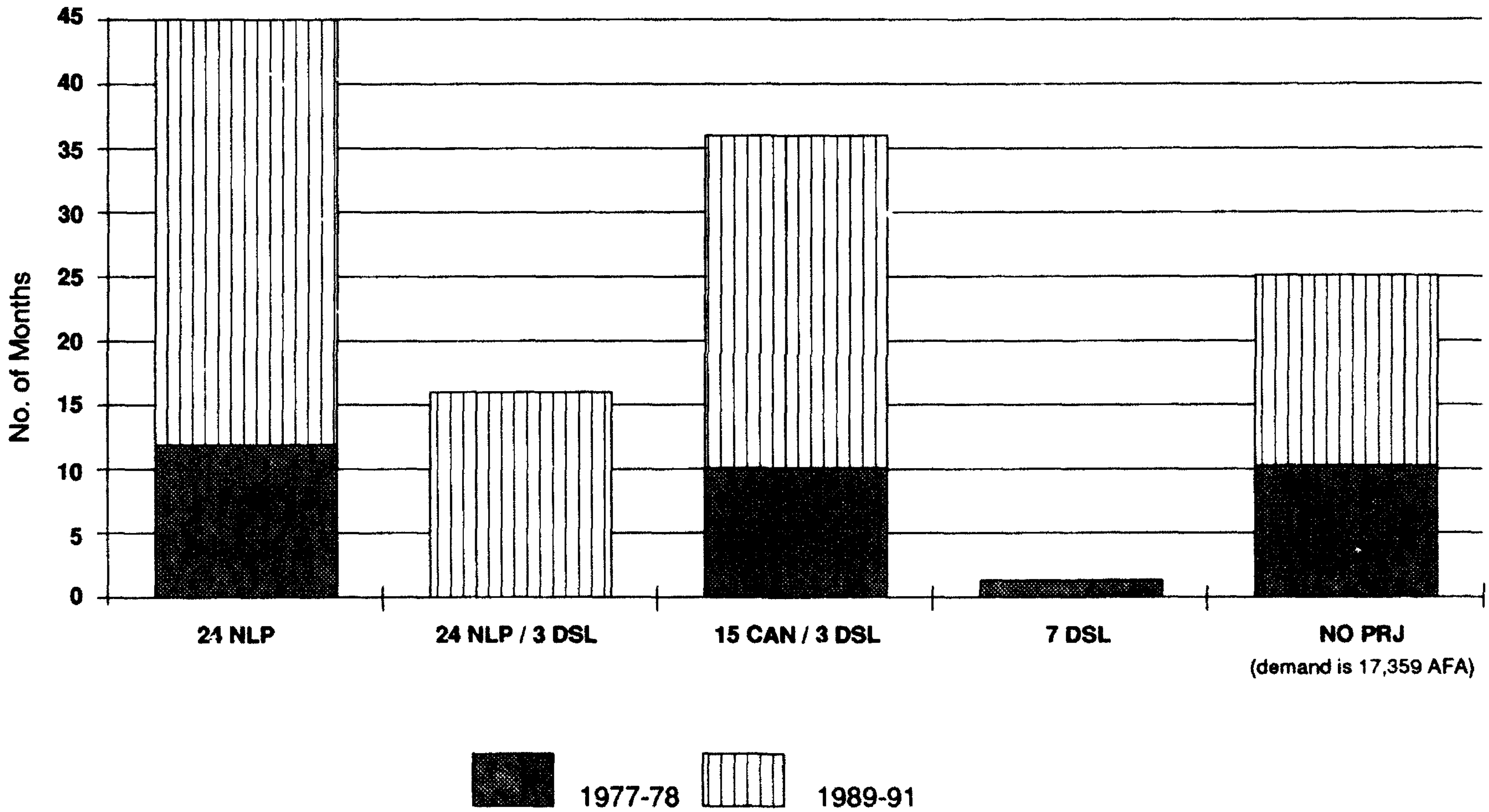
[2] System storage refers to the total usable storage available at the end of simulated February 1991.

[3] Percent annual demand refers to the percent of normal Cal-Am buildout demand of 22,750 AF.

Source: MPWMD

NUMBER OF MONTHS RATIONING IN TWO DROUGHT EVENTS AT BUILDOUT*
(1977-78 AND 1989-91)

FIGURE 5-5



* Buildout demand is 22,750 AFA, and applies to long-term projects only.

SOURCE: MPWMD

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5.4.2 24,000 AF NEW LOS PADRES RESERVOIR/DESALINATION (24 NLP/D)

The 24 NLP/D alternative would meet the District "90 percent goal" in all years except one at buildout, as shown in Table 5-2. The 21,020 AF yield from the 24 NLP/D alternative in simulated water year 1990 corresponds to a 12 percent shortage in that year, which is slightly greater than the desired maximum of a 10 percent shortage (Table 5-3). As shown in Figure 5-4, there would be 16 months of rationing in the 1989-91 period; three of those months would entail mandatory reductions of 25 percent in simulated year 1991.

Table 5-4 indicates that the total usable system storage remaining at the end of the worst drought period (February 1991) would be 11,310 AF, which represents about 50 percent of normal year Cal-Am demand at buildout.

Assessment

The 24 NLP/D project yield would fall just short (about 400 AF less) of the District Board's 90 percent performance goal in one out of 90 simulated years (and result in an eight percent shortage in one other year). Thus, the 24 NLP/D alternative is considered to be able to provide adequate supply to meet buildout demand.

The addition of the 3 MGD desalination plant to the 24,000 AF New Los Padres Reservoir would result in a significant improvement to municipal water supply at buildout. For example, with the desalination plant, there would be an additional 7,580 AF of Cal-Am demand satisfied in the 1987-91 period. The number of years with shortages would be reduced from five to two years; as shown in Figure 5-5, rationing would be eliminated with the 24 NLP/D alternative in the 1977-78 drought event. This alternative would also provide better water supply performance compared to the No Project (existing) situation, despite the significantly higher demand and provision of instream benefits.

5.4.3 15,000 AF CAÑADA RESERVOIR/DESALINATION (15 CAN/D)

The 15 CAN/D alternative would meet the District "90 percent goal" in all years except one at buildout, as shown in Table 5-2. The 20,150 AF yield from the 15 CAN/D alternative in simulated water year 1990 corresponds to a 15 percent shortage in that year, which is somewhat greater than the desired maximum of a 10 percent shortage (Table 5-3). There would be three other years with shortages of seven to nine percent as well. As shown in Figure 5-4, there would be 37 combined

months of rationing in the 1977-78 and 1989-91 periods; five of those months would entail mandatory reductions of 25 percent, and would occur in water years 1990 and 1991.

Table 5-4 indicates that the total usable system storage remaining at the end of the worst drought period (February 1991) would be 10,710 AF, which represents about 47 percent of normal year Cal-Am demand at buildout.

Assessment

The 15 CAN/D alternative would be able to meet the District Board's desired performance more than 95 percent of the time at a buildout demand of 22,750 AFA. In simulated water year 1990, the 15 CAN/D alternative would miss the 90 percent goal by about 1,300 AF; in order to attain the "90 percent goal" in all years, Cal-Am demand would need to be reduced to about 21,500 AF to 21,750 AF per year with this alternative.

As shown in Figure 5-5, the 15 CAN/D alternative would not perform as well as the 24 NLP/D alternative; there would be 10 months of rationing in the 1977-78 drought event. Also, it would not provide the same level of drought protection as the No Project (existing) situation, due to the significantly higher level of demand that would occur at buildout compared to the No Project demand level.

5.4.4 7 MGD DESALINATION (7 DSL)

The 7 DSL alternative would meet the District "90 percent goal" in all years, as shown in Table 5-2. The 22,760 AF yield from the 7 DSL alternative in simulated water year 1990 corresponds to a two percent shortage in that year (Table 5-3). As shown in Figure 5-4, there would be two months of rationing in the 1977-78 period; none would entail mandatory reductions of 25 percent.

Table 5-4 indicates that the total usable system storage remaining at the end of the worst drought period (February 1991) would be 14,825 AF, which represents about 65 percent of Cal-Am demand at buildout.

Assessment

Because the 7 DSL alternative achieves the 90 percent goal at all times, this alternative is considered to be able to provide adequate supply for buildout demand. As shown in Figure 5-5, this alternative would provide greater water supply benefits than any other long-term alternative as well as the No Project (existing) situation. It should be noted that the excellent simulated water supply performance of the 7 DSL alternative depends on very similar levels of pumping and diversion from the Carmel River that exist for the No Project alternative. As described in Chapter 4 (Section 4.9), the State Water Resources Control Board (SWRCB) is considering complaints against Cal-Am that allege that existing supply practices damage the public trust resources of the Carmel River. It is possible that the SWRCB could enact more stringent conditions on diversions from the Carmel River and pumping from the Carmel Valley alluvial aquifer. If this were the case, the performance of the 7 DSL alternative would be impaired.

5.4.5 NO PROJECT (NO PRJ)

The No Project alternative in this SDEIR/EIS-II reflects facilities and conditions expected in the year 1993. Annual water demand would be limited to 17,359 AF of Cal-Am production in a normal year. The No Project alternative would not meet the basic project purpose of providing adequate supply and drought protection for planned growth at buildout. As such, it is not directly comparable to the long-term alternatives described above due to the substantial difference in demand that is assumed.

The No Project alternative would meet the "90 percent goal" in all simulated years at the constrained water demand of 17,359 AFA. As shown in Figure 5-5, there would be about 10 simulated months of rationing in the 1977-78 drought, and 15 months in the 1989-91 event at this demand level. Only two months would entail a 25 percent reduction. It should be noted that this simulated performance is much better than what actually occurred in water years 1989-91 because the No Project alternative includes a new Paralta Well in Seaside that did not exist prior to 1993. The CVSIM model also assumes that all Cal-Am facilities are operational and entails a "hard-wired" rationing scheme that is tied to supply and demand expectations. In reality, Cal-Am wells may not always be operational due to equipment failures, and the Board may be influenced to be more conservative due to a concerned constituency.

If Cal-Am demand were allowed to increase to 22,750 AFA with the No Project facilities, the "90 percent goal" would still be met in about 88 percent of the water years simulated (Table 5-2). However, shortages of up to 30 percent would occur in droughts. There would be shortages greater than 10 percent in nine drought years, and greater than 1000 AF in another seven years. Significant shortages would occur in nearly every decade. Mandatory 25 percent rationing would be required in simulated water years 1931-32, 1948-49, 1961-62, 1977-78, and 1988-91. There would be a total of 161 months (more than 13 years) of rationing in the simulated 90 years.

Assessment

The No Project alternative would provide an adequate supply at a constrained level of demand (17,359 AFA), but would not meet the project purpose of providing supply for planned growth. The No Project facilities would be inadequate at higher levels of demand, and would entail chronic shortages and mandatory rationing. As described for the 7 DSL alternative above, complaints before the SWRCB have been filed against Cal-Am regarding existing water supply practices. It is possible that more stringent conditions could be placed on the use of the water resource system, which would affect the No Project performance. The SWRCB is expected to issue an order on the complaints in Spring 1993.

5.5 NON-CAL-AM WATER USERS

While most of this analysis focuses on the Cal-Am system, the impacts of projects on non-Cal-Am water users that draw from the water resources system are of interest, and were included in the CVSIM simulations. Theoretically, heavy pumping of large production wells in future droughts could lower adjacent groundwater levels. If water levels fall below the perforations of nearby, shallower private wells, water production could be impaired. Detailed groundwater modeling, coupled with knowledge about private well completions, would be required to determine the impact of specific municipal wells on individual private wells; such work is beyond the scope of this EIR/EIS.

As an approximation, information about the total usable storage in the aquifer subunits could indicate how non-Cal-Am users would be affected by projects, especially in dry or critically dry years. In general, projects that result in frequent instances of depleted aquifer storage (lowered water levels) have greater potential to impair non-Cal-Am water users. Projects that result in nearly full aquifers (high water levels) most of the time may provide benefits to non-Cal-Am users because less power

would be needed to extract water. Information about project impacts on aquifer storage is provided in Chapter 7, Hydrology.

6. GEOLOGY AND SEISMICITY

6. GEOLOGY AND SEISMICITY

6.1 SETTING

A large number of geologic studies at the alternative water supply project sites have been performed or are now underway. The following descriptions of regional and local (site) geology and seismicity conditions are based upon the results of these various studies. The reader is referred to Chapter 15, Public Health and Safety, for additional information concerning dam design criteria.

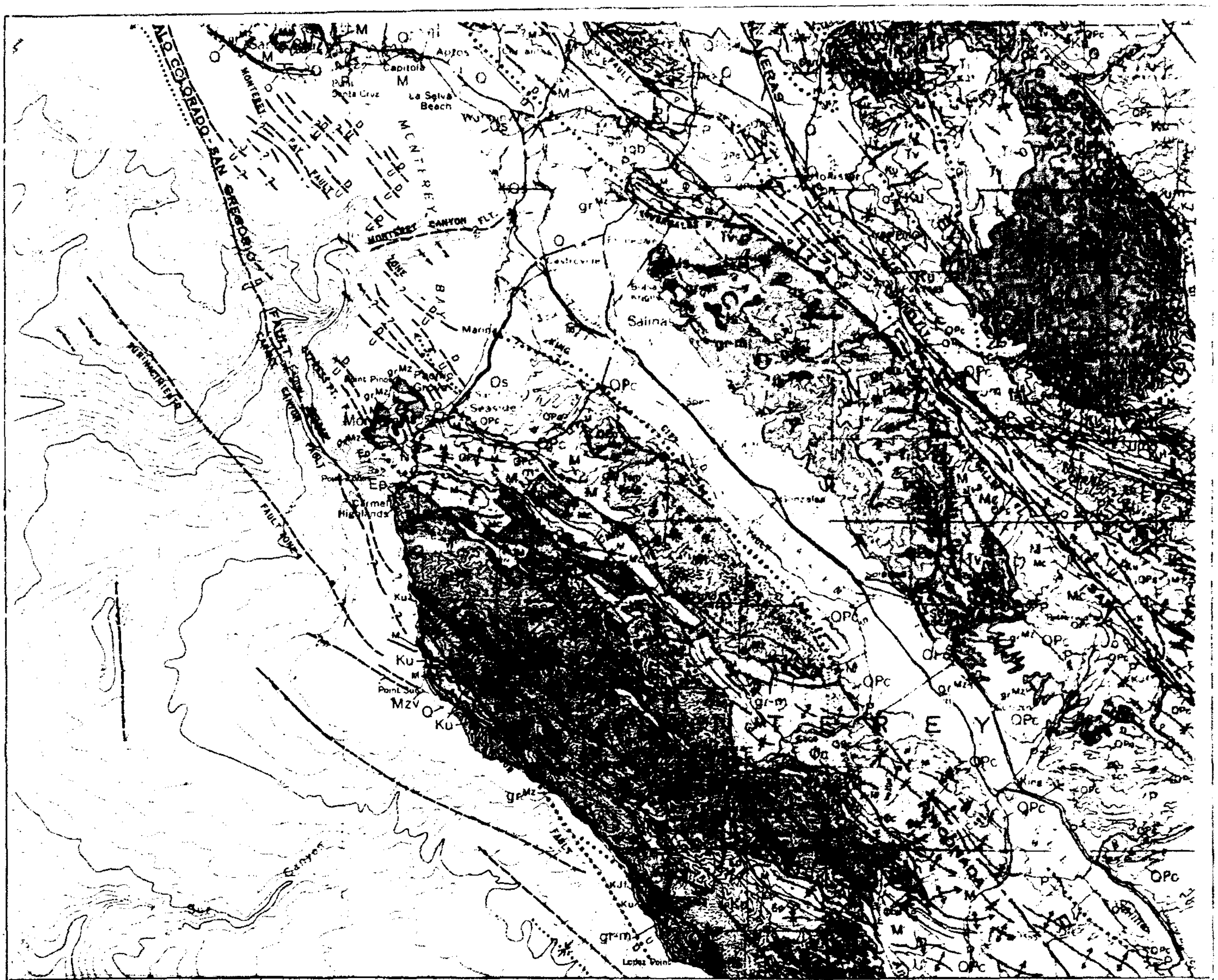
6.1.1 REGIONAL GEOLOGY

The water supply project alternatives described in this document are all located near the northern terminus of the Santa Lucia Mountains, which are within the central California Coast Range geomorphic province. Much of this province consists of an assemblage of granitic and metamorphic crystalline rocks of Mesozoic age and Cenozoic sedimentary rocks, collectively known as the Salinian Block. The Salinian Block is bounded by two major northwest-trending fault zones, as described below in Section 6.1.2, Regional Seismicity. The crystalline rocks form the basement and, in many places, are mantled by much younger sedimentary rocks of marine and non- marine origin, as well as by lesser amounts of volcanic rocks. The Cenozoic sedimentary rocks consist of two major rock types: consolidated sedimentary rocks of Tertiary age, and unconsolidated sediments of Quaternary age. The regional geology showing the location of major rock types and faults is shown in Figure 6-1.

Although the geologic history of the central California Coast Range province is not fully understood, it is widely believed that the numerous faults in this area are related to movement along the boundary between the Pacific and North American tectonic plates. Most geologists now recognize that the earth's crust consists of a number of these huge plates that "lie" on the ductile rocks of the earth's mantle. During the last 29 million years or so, the Pacific Plate on the west has been slipping, in a relative northwesterly direction, along the boundary with the North American Plate on the east. This movement is accompanied by fault activity.

REGIONAL GEOLOGY

FIGURE 6-1



- Fault traces. Solid, well located; dashed, approximately located or inferredd; dotted, concealed; and queried, continuous or existence uncertain.
- U / D: Upthrown side (relative or apparent) / Downthrown side (relative or apparent)
- Arrow indicates direction of dip.
- Regional strike and dip of stratified rocks.
- Anticlinial fold / Synclinal fold: Dotted offshore and where concealed under alluvium in the Great Valley and elsewhere.
- Qs: Extensive Quaternary marine and nonmarine sand deposits.
- Q: Quaternary alluvium, Lake, playa, and terrace deposits; unconsolidated and semi-consolidated
- QPc: Pliocene and/or Pleistocene sandstone, shale, and gravel deposits; mostly loosely consolidated.
- P: Tertiary (Pilocene) sandstone, siltstone, shale, and conglomerate; mostly moderately consolidated.
- M: Tertiary (Miocene) sandstone, shale, siltstone, conglomerate, and breccia; moderately to well consolidated.
- E: Tertiary (Eocene) shale, sandstone, conglomerate, minor limestone; mostly well consolidated.
- Ep: Tertiary (Paleocene) sandstone, shale, and conglomerate; mostly well consolidated.
- Tv: Tv: Tertiary volcanic flow rocks; minor pyroclastic deposits
- Ti: Tertiary intrusive rocks; mostly shallow plugs and dikes.
- Ku: Upper Cretaceous sandstone, shale, and conglomerate
- Kjf: Franciscan Compex. Cretaceous and Jurassic sandstone with shale, chert, limestone, and conglomerate
- Schists mostly Paleozoic or Mesozoic age; some Precambrian
- Granific and metamorphic rocks, mostly gneiss and other Metamorphic rocks injected by granitic rocks. Mesozoic to Precambrian
- Undivided pre-Cenozoic metasedimentary and metavolcanic rocks Mostly slate, quartzite, hornfels, chert, phyllite, mylonite schist, gneiss, and minor marble.
- Undivided Mesozoic volcanic and metavolcanic rocks, Andesite and rhyolite flow rocks, greenstone, volcanic breccia and other pyroclastic rocks; in part strongly metamorphosed
- Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite
- Ultramafic rocks, mostly serpentine Minor periodotite, gabbro, and diabase Chiefly Mesozoic
- Gabbro and dark dioritic rocks, chiefly Mesozoic

SOURCE: MODIFIED FROM JENNINGS, C.W. (1977), GEOLOGIC MAP OF CALIFORNIA

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The relative motion between these two tectonic plates is taken up largely along the northwestward-trending San Andreas fault system, which defines the regional boundary between the two plates. The plate boundary is actually made up of a zone of crustal deformation roughly parallel to the San Andreas fault zone, that may vary from several miles to over 100 miles wide. In addition to the San Andreas fault zone, another major northwest-trending fault zone, the Palo Colorado-San Gregorio fault zone, exists offshore and in the southern Santa Lucia Mountains. (This zone is described by some investigators as being an extension of the Hosgri fault zone to the south.) These two systems bound the Salinian Block in central California. A number of faults partially or wholly cross this block diagonally between the San Andreas and Palo Colorado-San Gregorio fault zones. Locally these include the Tularcitos, Cachagua, Chupines, Navy and Cypress Point faults. The relationship of each of these faults to dam site design criteria is discussed in Section 6.1.4.

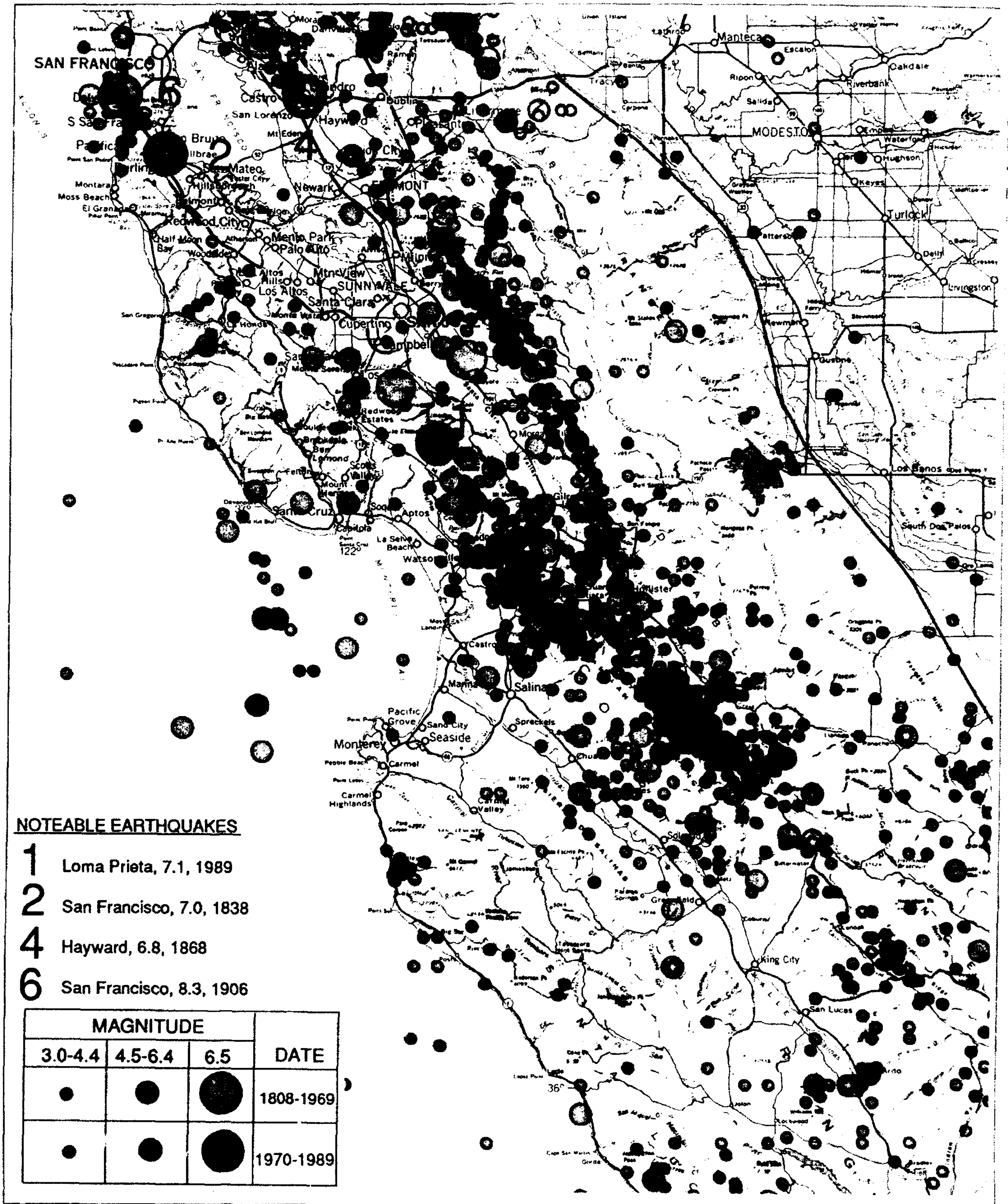
6.1.2 REGIONAL SEISMICITY

The water supply alternatives are located in a seismically active region between the San Andreas fault zone and the Palo Colorado-San Gregorio fault zone, which has been subjected to several strong earthquakes during historic time. The seismicity has been primarily attributable to components of the San Andreas fault system: the Calaveras, Hayward and San Andreas fault zones. Although historical seismic activity has been dominated by the San Andreas fault system, the Palo Colorado-San Gregorio Fault zone, which trends northwest along the outer margin of Monterey Bay, is also treated by most investigators as an active fault zone.[1] The locations of regional faults are shown in Figure 6-1.

A seismicity map for the San Francisco and Monterey Bay regions is shown in Figure 6-2. The map depicts the distribution of magnitude 3.0 and greater earthquakes since 1808, and shows that most seismic activity is clustered along the San Andreas Fault zone. The October 1989 Loma Prieta earthquake, with a Richter scale magnitude of 7.1, occurred along a section of the San Andreas Fault zone, and is the closest historic magnitude 7 or greater event in the project area. Two magnitude 6.1 earthquakes occurred offshore in Monterey Bay on the same day in 1926. The source for these events has been attributed to the Monterey Bay fault zone near its junction with the Palo Colorado-San Gregorio fault zone. However, the epicenters for earthquakes prior to the early 1960s were generally not accurately located.[2] The Monterey Bay Fault zone consists of a broad zone of numerous, short faults beneath Monterey Bay.

REGIONAL SEISMICITY MAP

FIGURE 6-2



SOURCE: MODIFIED FROM GOTER, S.K. (1988), SEISMICITY OF CALIFORNIA, 1808-1987, U.S.G.S. OPEN-FILE REPORT 88-286.

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6.1.3 LOCAL GEOLOGY AND LANDSLIDE POTENTIAL AT ALTERNATIVE PROJECT SITES

The geology in and around each alternative water supply project site, and the existing and potential landslide characteristics at each site are described briefly in this section. The locations of each of the dam sites is shown in Figure 4-1.

24,000 AF New Los Padres Reservoir

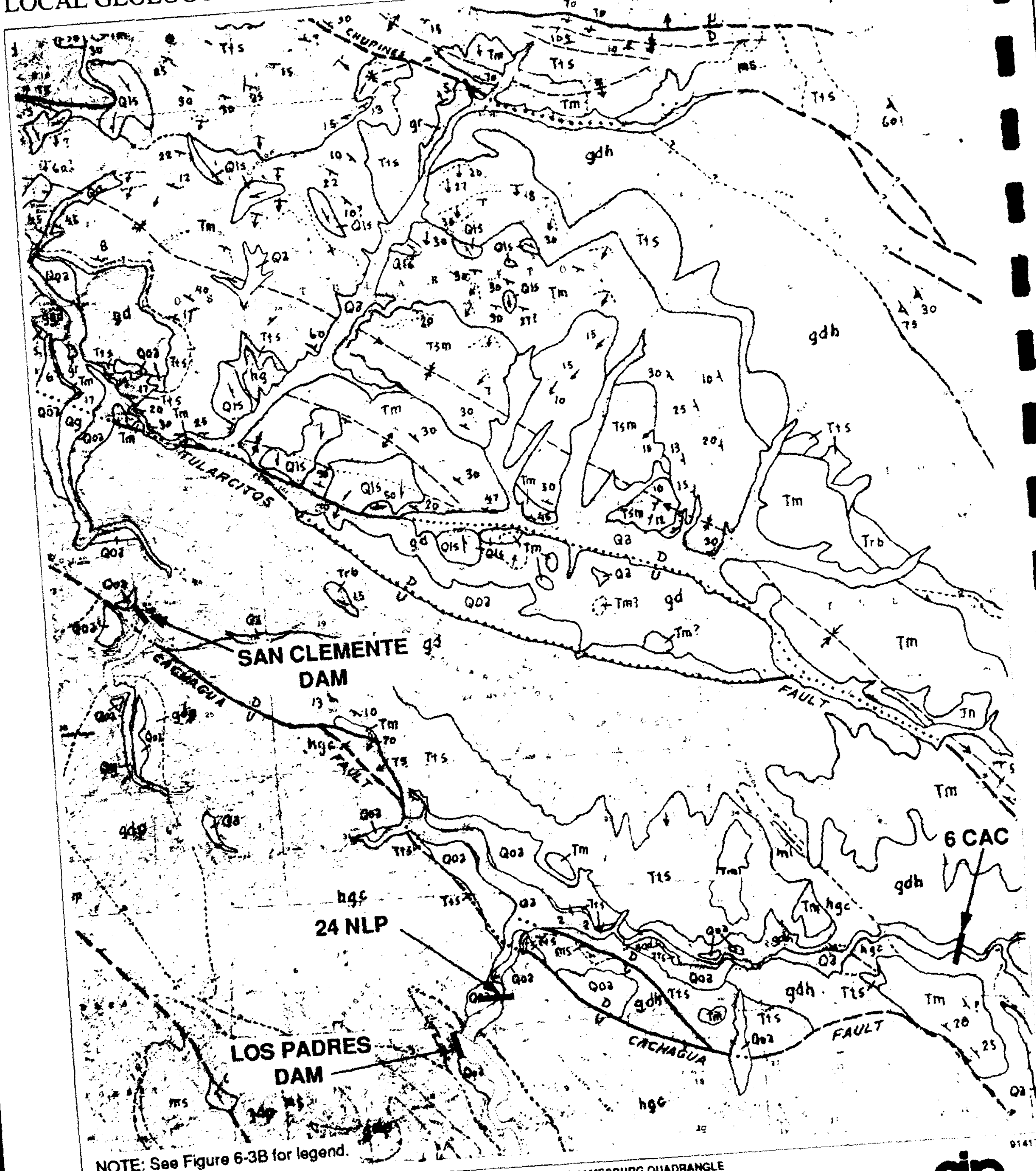
The 24,000 AF New Los Padres Reservoir site is underlain primarily by Mesozoic age granitic rocks. These igneous rocks contain some inclusions of older metamorphic rocks, probably of the Sur Series. These rocks are relatively impermeable so leakage should be negligible. The geology of the site vicinity is shown in Figure 6-3.

River terrace deposits comprised of unconsolidated silt, sand, gravel and boulders up to three feet in diameter overlie portions of the bedrock on both the right and left abutments of the proposed dam site. The right abutment is gently sloping and covered with deep soil; the left abutment is steep and consists of rock outcrops, residual soil, slopewash and unconsolidated terrace deposits. The orthogonal joint pattern that exists in the bedrock has divided the rock into rectangular blocks which range in size from less than a foot to about three feet.[3] Core drilling at the dam foundation site shows that fractures are closely spaced but tight. The fracture data indicate that the rock has a high angle of internal friction (probable high shear strength) and a low hydraulic conductivity (probable low seepage), both positive attributes for a dam foundation.[4] As a precautionary measure, foundation grouting has been recommended.

No landslides were mapped in the area of the proposed dam foundation.[5] Detailed field reconnaissance and mapping of existing or potential landslides in the area above the proposed reservoir have not been conducted. However, it is anticipated that during the life of this project, the area would be subject to numerous small translational (planar) landslides. The total volume of the landslides in the reservoir area is expected to be between 500 and 1,000 acre-feet. This volume is small compared to the size of the proposed reservoir. Given their small volume, the rapid movement of active landslides into the reservoir is not expected to be significant enough to generate a wave that would damage or overtop a dam at this location.

FIGURE 6-3A

LOCAL GEOLOGY OF NEW LOS PADRES RESERVOIR SITE



SOURCE: MODIFIED FROM U.S.G.S. OPEN FILE MAP 74-1021; GEOLOGIC MAP OF THE JAMESBURG QUADRANGLE

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LOCAL GEOLOGY OF NEW LOS PADRES RESERVOIR SITE (LEGEND)

FIGURE 6-3B

MAP SYMBOLS

CONTACT:
dashed where gradational
or approximately located

FAULT:
dashed where uncertain
dotted where concealed
U-upthrown side
D-downtrown side
arrows indicate
possible horizontal movement
arrow indicated observed
dip of fault plane

AXIS OF FOLD SHOWING
DIRECTION OF PLUNGE:
anticline

syncline

STRIKE AND DIP OF STRATA:
incline

vertical

overturned

STRIKE AND DIP OF FOLIATION:
inclined

vertical

Direction of downward
movement of landslide

GENERALIZED DESCRIPTION MAP UNITS

Qg
Qa

SURFICIAL DEPOSITS
Qg, stream-channel
sand and gravel
QA, alluvium (gravel,sand and clay)

Qls

LANDSLIDE DEBRIS

Qoa

OLDER ALLUVIUM

Tn

UNNAMED NON MARINE
SANDSTONE AND SILTSTONE

Tsm

SANTA MARGARITA
marine white sandstone

Tm
Tml
Tmc

MONTEREY SHALE (marine)
Tm, upper part: siliceous shale,
Tml, lower part; soft, fissile and
thin bedded siliceous shale
Tmc, clay shale and soft fissile shale

Tts Tva

MARINE SANDSTONE
Tts, sandstone
Tva, basic andesitic flows

Trb

UNNAMED REDBEDS
(non marine sandstone
siltstone and conglom)

Tcc Tcs

CHURCH CREEK FORMATION
Tcs, sandstone
Tcc, siltstone

Ttr

THE ROCKS SANDSTONE
(marine sandstone)

Tl

LUCIA SHALE

Tj

JUNIPERO SANDSTONE

gr
gd gdh gdx gdp qd hgc

GRANITIC ROCKS
gr, quartz monzonite, leucocratic
gd, granodiorite
gdh, granodiorite, with hornblende
gdx, granodiorite, with hornblende
& phenocrysts of pink feldspar
gdp, granodiorite,with phenocrysts of felspar
qd, quartz diorite
hgc, heterogeneous granitic complex
(mixtures of granitic rocks and
metasedimentary rocks)

hg

HORNBLENDE GABBRO-DIORITE

um

ULTRAMAFIC ROCKS

ml ms msc

METASEDIMENTARY ROCK
ml, marble
ms, schist-gneiss
mscc, schist

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15,000 AF Cañada Reservoir

The Cañada Reservoir site is located in the Sierra de Salinas Range, which is just north of the Santa Lucia Range. The Sierra de Salinas Range is characterized by more rolling and less rugged topography than the Santa Lucia Range, but it is an area of high relief, with elevations rising to over 1,000 feet above sea level a short distance from the site.

The geology within and surrounding the reservoir site is almost entirely composed of sedimentary rocks of the Tertiary age Monterey Shale. The Monterey Shale in this area consists of low density, brittle, variably bedded, siliceous shale deposits, characterized by white to light brown color in outcrop. In the area of the dam foundation, bedding dips gently to the north-northeast. Depth to unweathered, competent bedrock is quite variable, up to approximately 200 feet on the left (east) abutment slope.[6]

Several old landslide masses and debris slope colluvium deposits have been identified in the area surrounding the proposed reservoir.[7] The locations of these structures are shown on Figure 6-4. In 1990, the geologic structures and foundation conditions within and surrounding this reservoir site were the focus of an extensive geotechnical exploration program designed to provide additional clarification regarding the site geologic features, as described in previous reports.[8] Investigators concluded that the site should provide a suitably strong dam foundation for an earthfill embankment structure, upon the excavation and removal of: (1) potential slide debris as thick as 60 feet on the downstream left abutment; (2) landslide deposits as thick as 140 feet on the upstream left abutment; and (3) weathered, possibly disturbed Monterey Shale as thick as 50 feet on the right abutment.

Due to the permeabilities of the bedrock encountered in drill holes, several "pathways" have been identified along which leakage could occur from the reservoir. Although existing subsurface information is not sufficient to characterize leakage potential with a high degree of certainty, it has been estimated that the total leakage is likely to range from 1,000 to 3,000 gallons per minute when the reservoir is full, with most of the leakage occurring through the bottom and sides of the reservoir.[9] Construction of a grout curtain would likely be required to minimize seepage through the dam foundation.

Desalination Alternatives

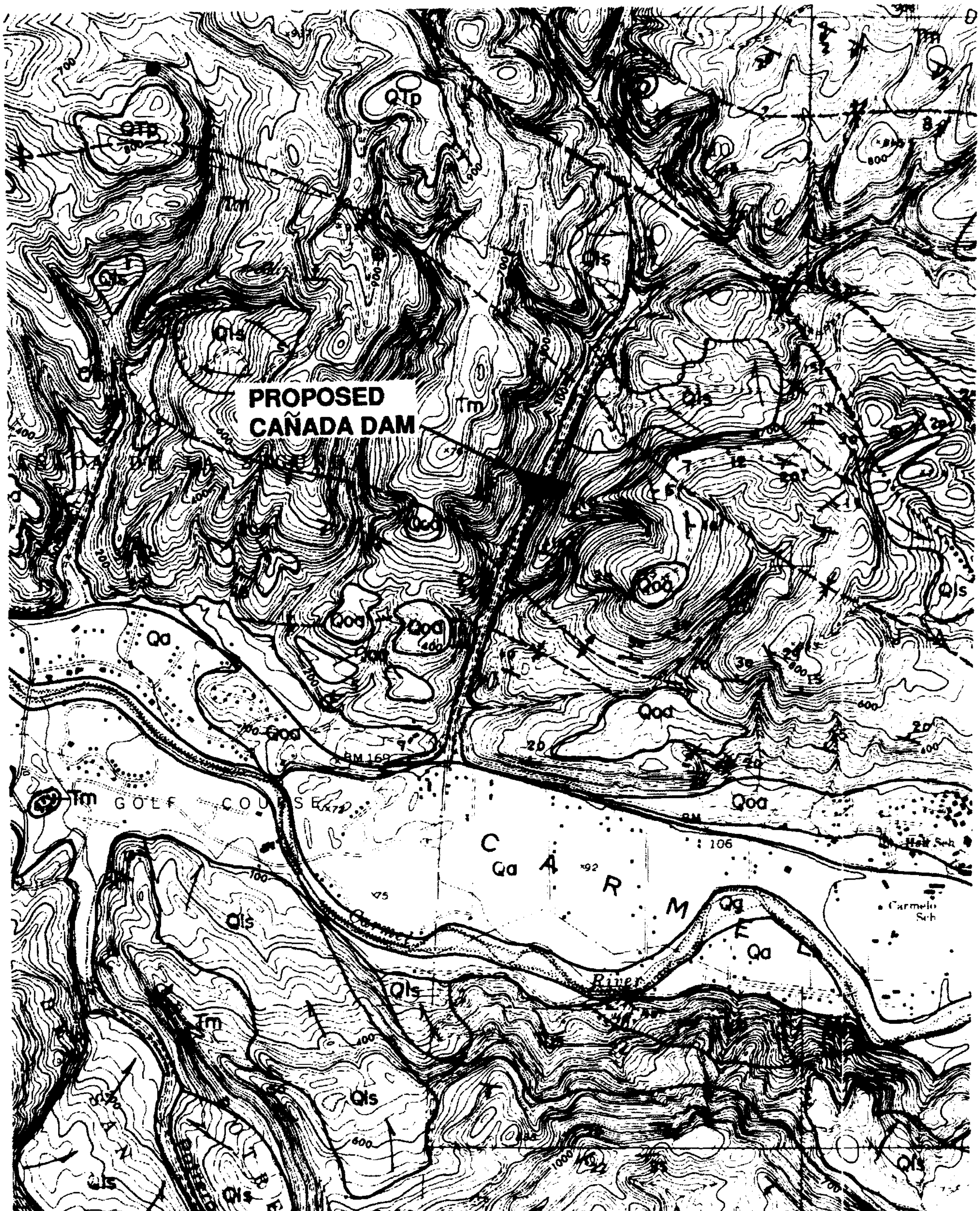
Desalination alternatives would be located in Sand City and/or northeast of Marina (Figure 4-1). In the project area, the crystalline basement rock is Cretaceous age (80 million years old granodiorite), which has been buried beneath several thousand feet of Tertiary and Quaternary age sediments.[10] The granitic rock is exposed at the ground surface on the Monterey Peninsula and on the sea floor directly off-shore and northeast of the City of Monterey. However, within the Monterey Bay Fault Zone a relatively thin (40 meters thick) sheet of Tertiary age (12 million year-old) Monterey Shale rests directly on the granodiorite and is exposed on the sea floor.[11] Folding of the Tertiary sediments is extensive and varied. There are many synclinal and anticlinal folds which are highly compressed, fractured, and asymmetrical.[12]

In the southern portion of Monterey Bay, several of the faults that have been found off-shore within the Monterey Bay Fault Zone displace Holocene deposits.[13] These faults appear to connect with faults mapped on-shore: the Tularcitos/Navy Fault, the Chupines/Seaside Fault, and the Ord Terrace Fault. In addition, the Reliz/King City Fault has been mapped along the southwestern banks of the Salinas River southeast of Monterey Bay trending toward the City of Marina. All of these faults have been evaluated by the California Division of Mines and Geology (CDMG) as part of their updating of Alquist-Priolo Special Studies Zones Maps. The CDMG determined that none of these faults was "sufficiently active or well defined" to be included in a Seismic Studies Zone Map.[14]

The Quaternary and Holocene age sediments exposed on-shore in the project area are relatively young, poorly cemented sands deposited along river channels and in sand dunes.[15] Ground water is present within all of these deposits at relatively shallow depths below the existing ground surface, particularly near the ocean. Dune sands cover the area from the City of Monterey to the Salinas River and extend as far inland as 5 miles.[16] In the Marina area, the dune sands are inferred to overlie the fluvial deposits that constitute the major water-bearing units of the Salinas Basin. Based on borings performed in the area, Holocene age dune sand is found to a depth of about 50 feet, underlain by a 45-foot section of late Pleistocene, younger alluvium. Interbedded sand, clay and gravel deposits encountered in borings are interpreted to be older alluvium associated with past meanders of the ancestral Salinas River.

LOCAL GEOLOGY OF CAÑADA RESERVOIR SITE

FIGURE 6-4A



SOURCE: MODIFIED FROM CLARK ET AL (1974)

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LOCAL GEOLOGY OF CAÑADA RESERVOIR SITE (LEGEND)

FIGURE 6-4B

MAP SYMBOLS

CONTACT:
dashed where gradational
or approximately located

U
D

FAULT:
dashed where inferred;
dotted where concealed.
U-upthrown side
D-downtrown side

FOLD AXIS SHOWING
DIRECTION OF PLUNGE

anticline

syncline

STRIKE AND DIP OF STRATA:

20

inclined

vertical

overturned

horizontal

direction of dip from
distant view

GENERALIZED DESCRIPTION OF MAP UNITS

Qg

Qa

Qls

SURFICIAL SEDIMENTS
Qg, river sand and gravel
Qa, alluvium
Qls, landslide debris

Qoa

OLDER SURFICIAL SEDIMENTS
Older alluvium and terrace
gravel and sand

QTp

PASO ROBLES FORMATION
Old valley-fill alluvium. Light-gray
gravel, sand and clay

Tmd

Tm

MONTEREY SHALE
Tmd, Diatomite, white, soft,
punky, commonly silty
Tm, Siliceous shale, light-brown to
white, hard, brittle, platy

Tss

MARINE SANDSTONE
Buff to light-gray, friable arkosic
sandstone, locally pebbly

Tvb

VOLCANIC ROCKS
Flows and flow breccias of basalt
and basaltic andesite

gdp

GRANITIC ROCKS
Granodiorite, porphyritic

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No Project

The No Project alternative includes the existing Los Padres and San Clemente Reservoirs combined with a new well in the Seaside Coastal Groundwater Subbasin. The geology at the existing Los Padres Reservoir is described above. The hydrology of the Seaside groundwater basin is described in Section 7.1.3. The bedrock in the vicinity of San Clemente Dam consists primarily of Mesozoic age igneous rocks (granite and granodiorite) with metamorphosed inclusions of older sedimentary rocks that the igneous rocks intruded. Moderate fracturing of the bedrock has contributed to extensive near-surface weathering. The canyon in the area is V-shaped with steeply sloping sidewalls and a minor accumulation of unconsolidated alluvium at the bottom.

6.2 SEISMIC DESIGN CRITERIA AND STANDARDS OF SIGNIFICANCE

Seismic design criteria for the alternative dam sites have been developed based upon conclusions reached about the activity, proximity, length, displacement and continuity of nearby faults. Of great importance from the point of view of dam design is the question of the recency of activity of local faults. According to the California Division of Mines and Geology, an active fault is defined as one that has undergone surface displacement within Holocene time, i.e., within the last 11,000 years.[17] A potentially active fault is one that shows evidence of surface displacement before the Holocene Epoch, but during Pleistocene time. The Pleistocene Epoch is considered to have started approximately 2 to 3 million years ago.

An important parameter for establishing potential site seismicity is determination of the maximum credible earthquake (MCE) of local active or potentially active faults. MCE is the maximum earthquake that appears capable of occurring under the presently known tectonic framework.[18] Seismic site parameters of: (1) peak horizontal ground acceleration; (2) duration of strong ground motion; and (3) peak ground velocity, can be derived based upon estimated MCE's and distances to the faults.

24,000 AF New Los Padres Reservoir

No faults have been noted at the new Los Padres Dam embankment site or within the reservoir inundation area; however, the closest point on the Cachagua fault is located about 0.5 kilometers downstream from the proposed dam axis.[19] The Cachagua fault, which separates granitic rocks from Tertiary age sedimentary rocks, is probably not active.[20,21] For conservative purposes, however, the Cachagua fault was included in the seismicity analysis of this site. The preliminary analysis

indicates that the Cachagua fault, with an MCE magnitude of 6.25 and a peak horizontal ground acceleration of 0.55 g (units of gravity), is the fault that would control the seismic design criteria for the New Los Padres Reservoir.[22] This information is summarized along with data from the other reservoir sites in Table 6-1.

The active San Andreas Fault is located approximately 47 kilometers away at its closest approach to this site. An estimated 7.8 MCE magnitude along the San Andreas Fault would be expected to produce a peak horizontal ground acceleration of 0.16 g at the Los Padres site.[23] No strong-motion instruments are presently located at or near the Los Padres site; therefore, no strong-motion records are available for the 7.1 Richter magnitude Loma Prieta earthquake of October 17, 1989. However, as a means of comparison with nearby areas, this recent earthquake resulted in the strongest shaking recorded of 0.64 g peak horizontal ground acceleration at the town of Corralitos, which is within one kilometer of the slipped San Andreas Fault.[24] Ground acceleration measurements in the San Francisco Bay area were generally on the order of 0.10 to 0.15 g, although several records were obtained at sites with deep soil deposits where peak acceleration ranged between 0.25 and 0.30 g.[25]

As with any of the dam alternatives considered, final seismic design criteria would be developed cooperatively with the responsible agencies, including the California Department of Water Resources, Division of Safety of Dams (DSOD).

15,000 AF Cañada Reservoir

Several local faults, including the Berwick, Chupines, Cypress Point, Navy and Tularcitos faults, extend within seven kilometers of the Cañada Dam site. These "near-field" sources are active or potentially active faults that could significantly affect the site. The closest fault is the Navy Fault, which traverses through the reservoir portion of the site and is possibly a branch or continuation of the Tularcitos Fault. The seismicity analysis performed for this site indicates that none of these local faults would be expected to contribute the greatest seismically-induced ground motion. Rather, the active, regional Palo Colorado-San Gregorio Fault zone (estimated MCE = 7.5), located 11.3 kilometers to the west, would produce the maximum ground-shaking potential, with an estimated peak horizontal ground acceleration of 0.65 g. By comparison, an estimated MCE of 6.7 is assessed for the near-field sources, with an estimated peak horizontal ground acceleration of 0.60 g.[26]

TABLE 6-1

SUMMARY OF SEISMIC DESIGN CRITERIA FOR
ALTERNATIVE WATER SUPPLY PROJECT DAM SITES

Dam Site	Fault with Maximum Ground Shaking Potential	Fault Activity[1]	Maximum Credible Earthquake Magnitude (Richter Scale)	Minimum Distance to Dam Site (Kilometers)	Peak Horizontal Ground Acceleration (Units of Gravity)
New Los Padres[2]	Cachagua	PA	6.25	0.5	0.55
Cañada[3]	Palo Colorado	A	7.50	11.3	0.65

[1] A = Active
PA = Potentially Active
[2] Source: Bechtel Corporation (1992)
[3] Source: Norman Janke Associates (1989) and Brown & Caldwell Consultants (1990).

Desalination Alternatives

Two alternative desalination plant sites have been described in the Near-Term Desalination Project EIR. Any desalination facility built would be designed to meet the applicable seismic safety standards. This would be true for the 3 MGD plant associated with the New Los Padres or Cañada projects, as well as the 7 MGD alternative, which entails desalination plants at the Sand City and Marina sites.

No Project

This alternative entails existing dams at Los Padres and San Clemente (built in 1948 and 1921, respectively), as well as a new well in the Seaside Coastal Groundwater subbasin. Based on a recent evaluation of the existing San Clemente Dam by DSOD, structural improvements to the dam may be needed to meet current seismic safety standards. Cal-Am is engaged in ongoing studies to determine which improvements are necessary.

6.3 IMPACTS AND MITIGATION MEASURES OF PROJECT ALTERNATIVES

Each of the alternative water supply project sites is discussed below in terms of the impacts from project construction and operation on the geologic resources of the area, and recommended mitigation measures. Unless otherwise noted, all identified impacts are considered to be significant adverse impacts. Corresponding mitigation measures, unless otherwise noted, would be sufficient to reduce impacts to a less than significant level.

6.3.1 24,000 AF NEW LOS PADRES RESERVOIR (24 NLP)

Rock would be mined near the dam site and crushed for use as aggregate for concrete dam construction. Potential borrow areas for aggregate are shown on Figure 4-4. An estimated 530,000 cubic yards of rock would be excavated from one or more of the borrow areas.

Some material would be excavated at the dam site to construct the dam foundation. Weathered rock and loose materials would be removed and cracks or fissures filled with concrete to provide a strong bearing surface and a good seal between the rollcrete dam and the bedrock foundation.

Impact 6.3.1-1

Activities associated with dam construction would result in the exposure of new soil or rock surfaces that will be more vulnerable to erosion than the undisturbed surfaces.

The disturbance of soil and underlying strata that would occur during construction of this proposed project would result in a period of increased erosion. Mining of rock for aggregate would require the removal of vegetation from portions of the canyon sides and the construction of haul roads or conveyers to transport rock to the crusher and concrete batch plant. Preparation of the dam foundation and establishment of a crusher, batch plant and staging areas would require the clearing of vegetation and some excavation. The widening of haul roads to improve access for construction vehicles would involve some excavation and grading. In addition, some widening involving excavation and grading may be needed on Monterey County roads leading into the site to allow access for heavy equipment. A significant amount of erosion could occur during project construction.

Mitigation Measure 6.3.1-1

The following mitigation measures are recommended to reduce the rate of erosion during and immediately following the construction period to a less than significant level:

a) Minimize vegetation clearing and earthwork outside the inundation area.
b) Establish slope design criteria that are appropriate to the geologic characteristics of the site.
c) Strip, store and replace topsoil in flat and gently sloping areas outside the inundation area, where they are not subject to ground disturbance.
d) Reseed or plant disturbed areas outside the inundation area with fast-growing plant species compatible with the present vegetation types.
e) Build drainage structures that would route stormwater around easily erodible surfaces.
f) A 1601-03 stream alteration agreement with the California Department of Fish and Game would be required to protect spawning habitat. Methods such as regravelling may be required.
g) Reclaim and restore all non-inundated quarry or mining sites to conditions resembling predisturbance in accordance with the State mining and reclamation act.

The dam and reservoir of the 24,000 AF New Los Padres project would inundate a maximum of 273 acres (Figure 4-4). The geologic resources of this area are unremarkable and have no special or unusual geologic value. The lands to be flooded are underlain primarily by granitic rocks with a variable mantle of soil, river terrace deposits and highly weathered bedrock. At the upstream end of the existing Los Padres Reservoir, there is a delta formed mostly from silt and clay-sized sediments

that washed down from the upper watershed following the Marble Cone Fire in 1977. This sediment delta now occupies approximately 890 acre feet, or 29 percent of the original reservoir storage capacity.

Impact 6.3.1-2

Operation of the 24,000 AF New Los Padres Reservoir could trigger reservoir-induced seismicity (RIS).

The phenomenon of RIS has been known to occur where large reservoirs have triggered seismic events. Detailed studies have shown that RIS most commonly occurs during or immediately following impoundment and filling or rapid drawdown. Rarely has RIS been known to occur more than about five years after impoundment.[27] It should be stressed that the added load resulting from the reservoir is not sufficient to cause earthquake activity or to increase the magnitude of these events; reservoir impoundment can only act as a triggering mechanism. On a worldwide basis, RIS has almost exclusively been attributed to reservoirs that are much larger and deeper than the New Los Padres Reservoir. Thus, this impact is considered less than significant.

Mitigation Measure 6.3.1-2

No mitigation is required. However, the 24,000 AF New Los Padres Dam would be designed to withstand the MCE for this site, which would include seismic forces that might be triggered by RIS.

Impact 6.3.1-3

Operation of the 24,000 AF New Los Padres Reservoir could trigger additional landsliding into the reservoir.

The engineering geology of the Los Padres Reservoir area has not been extensively investigated. However, it is anticipated that this area would produce small translational landslides as described in Section 6.1.3, based upon the reconnaissance mapping available. It is therefore assumed that this impact would be less than significant. The potential for landslide movement into the reservoir can be minimized by removing and/or repairing potentially unstable slopes prior to project construction.

Mitigation Measure 6.3.1-3

Additional field investigation will be performed to further define landslide potential within and above the proposed reservoir site. Potentially unstable slopes will be monitored and remedial actions will be taken, if necessary, to remove and/or repair them prior to project operation.

6.3.2 24,000 AF NEW LOS PADRES RESERVOIR WITH 3 MGD DESALINATION PLANT (24 NLP/D)

Construction methods, impacts and recommended mitigation measures for the 24,000 AF New Los Padres/Desalination Project would be the same as those described in Section 6.3.1. Reservoir impacts would also be the same as those described in Section 6.3.1.

Impacts and mitigation measures associated with the 3 MGD desalination plant are described below.

Impact 6.3.2-1

The project could result in temporary unstable earth conditions associated with excavation in areas of saturated soils and sands.

The presence of shallow ground water in the project area may present a hazard to worker safety. This would constitute a significant adverse impact. In such areas, dewatering may be impractical due to the high permeability of the sand deposits. Special provisions may be needed to minimize the potential for ground failure associated with saturated soils.

Mitigation Measure 6.3.2-1

Site-specific geotechnical investigation would be required to assess the potential for unstable earth conditions to present a hazard to worker safety and to identify appropriate methods to reduce this hazard.

Implementation of this mitigation measure would reduce this impact to a less than significant level.

Impact 6.3.2-2

Implementation of the project would involve grading, excavation or other earthmoving activities which could cause disruptions, displacements, compaction or overcovering of soils; changes in ground surface relief features; and erosion.

It is the responsibility of local governments to mitigate potentially significant adverse impacts resulting from construction activities through their discretionary permit authority over site-specific land uses. Conditions should be placed on the project to control erosion and ensure grading is conducted in conformity with accepted practices. The District would also be required to mitigate the impacts of development by implementing grading sensitive to the local landscape.

Mitigation Measure 6.3.2-2

(a) *Construction activities associated with the desalination project would both minimize grading and excavation, and balance import and export of earth materials to the extent feasible given project design.*

(b) *Grading and excavation associated with the project would be performed so as to cause minimal erosion. Where necessary, the project would include grading and erosion control plans. Techniques to minimize erosion would include, but not be limited to, avoiding winter earth moving activities where feasible, leaving rough graded surfaces to facilitate revegetation, using coverings and mulches on disturbed areas, and replanting as soon as possible after construction.*

Implementation of the above mitigation measures would result in less than significant impacts.

Impact 6.3.2-3

Implementation of the project may cause development in areas of geotechnical hazards such as earthquake faults, or subsidence or liquefaction areas. Such development could expose people and property to geologic hazards and constitute a significant adverse impact.

The proposed project does not involve residential development or land use. The following discussion relates specifically to geologic hazard conditions at the Sand City site.

Liquefaction. The pipeline route for the Sand City site does not appear to involve areas with liquefaction potential. However, if the proposed project is approved, a site-specific geotechnical investigation would be needed to verify that liquefaction is not a potential problem at the selected site and its associated pipeline route.

Fault Rupture. The proposed pipeline may cross the Ord Terrace Fault and the Seaside Fault. Site-specific investigations for the design of the pipeline would be needed to address the hazard presented by surface rupture and to determine remedial measures if significant impacts are identified.

Tsunami. The proposed Sand City plant site appears to be sheltered from potential earthquake-induced sea waves because the site is inland of a high dune barrier and Highway 1. Tsunami are relatively rare events and are usually considered as exceeding the design parameters for projects such as the proposed project.[28] Therefore, the issue is not usually addressed directly by any specific engineering requirements. Replacement of damaged elements is the typical means of mitigating this hazard.

It is the responsibility of local governments to mitigate impacts resulting from placing development in areas of geologic hazard through their discretionary permit authority over site-specific land uses. Conditions would be placed on the project to avoid development in areas where standard engineering practices would not be expected to overcome potential geologic hazards to people or property. The District would also be required to mitigate the significant impacts of development by meeting design requirements to minimize the effects of geotechnical hazards that may be encountered at specific sites.

Mitigation Measure 6.3.2-3

Site-specific geologic reports would be required to evaluate potential geologic hazards and to identify design and/or construction methods to reduce the effects of the geologic condition(s) on the project, as described above. The project would be required to incorporate the recommendations of the site-specific geotechnical investigations. Geotechnical reports would be prepared by a geologist registered in the State of California.

Implementation of this mitigation measure would reduce potential impacts from geotechnical hazards to a less than significant level. As the project is expected to comply with applicable regulations and, where necessary, incorporate the recommendations of site-specific geologic reports, it would not be expected to create significant geologic impacts related to exposing people or property to geologic hazards.

Impact 6.3.2-4

The project could result in changes in deposition or erosion of beach sands during construction and operation of the proposed project.

The proposed plant site is located adjacent to active sand dunes in Sand City, and it is possible that there could be significant migration of sand dunes during wind storms in the area. A sizable parking area lies between the existing building (where the desalination facility would be located) and the toe

of the existing sand dune. This area is expected to provide a "buffer" and allow some time for response to sand dune migration. Without mitigation, this impact could potentially be considered significant.

Mitigation Measure 6.3.2-4

Migrating sand would be periodically removed, or the leeward portion of the dune would be stabilized using vegetative or mechanical means.

Implementation of this measure would reduce this impact to a less than significant level.

6.3.3 15,000 AF CAÑADA RESERVOIR WITH 3 MGD DESALINATION PLANT (15 CAN/D)

An estimated 21 million cubic yards of on-site material would be available for excavation from the borrow sites listed in Table 6-2. Construction methods are described in Chapter 4. Impacts associated with dam construction and recommended mitigation measures are similar to those described in Section 6.3.1. Desalination plant effects are described in Section 6.3.2.

The dam and reservoir in Cañada de la Segunda Canyon would inundate approximately 200 acres (Figure 4-14). Bedrock at the site is composed of siliceous shale with unconsolidated colluvial and landslide deposits. There are no remarkable, special or unusual geologic resources at the site. The possibility of RIS at the Cañada Reservoir site is based on the presence of the Navy Fault, historic microseismic activity and the fractured nature of the Monterey Shale bedrock. However, it is hypothesized that induced earthquakes here would be on the order of Magnitude 4, which is less than the design event for this site of 7.5 MCE along the Palo Colorado-San Gregorio Fault system.[29]

There is a very high potential for reactivation of several extensive old landslide deposits on the east and west sides of the reservoir, resulting from reservoir filling. The effects of renewed landslide activity at this site would not only be confined to the limits of the reservoir area, but could extend far above the maximum reservoir elevation. A substantial portion of these landslide deposits could be utilized as dam embankment construction material if this alternative is selected. Portions of the slides on the upper slopes could probably be left in place and buttressed; however, this would need future investigation to further define the limits and geometry of these slides.[30]

TABLE 6-2

ESTIMATED AVAILABLE QUANTITIES OF
ON-SITE CONSTRUCTION MATERIALS FOR CAÑADA DAM

Source	Estimated Quantity (Cubic Yards)
Dam Foundation Excavation	7,000,000
East Landslide (excluding dam foundation)	11,000,000
West Landslide	2,000,000
Navy Fault Zone	900,000
Channel Alluvium	300,000
TOTAL	21,200,000

Apply average estimated shrinkage factor of 20 percent:
(21,200,000) (0.8) = 16,960,000 c.y. (compacted).

Source: Brown & Caldwell, 1990.

The operation impacts of the reservoir and recommended mitigation measures are similar to those described in Section 6.3.1. The desalination-related effects would be the same as those described in Section 6.3.2.

6.3.4 7 MGD DESALINATION PROJECT (7 DSL)

Refer to previous discussion on 3 MGD desalination site in Section 6.3.2.

6.3.5 NO PROJECT ALTERNATIVE (NO PRJ)

There are no geologic impacts or recommended mitigation measures associated with project construction or operation under this alternative.

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3. Bechtel Civil, Inc., New Los Padres, New San Clemente and San Clemente Creek Projects, Preliminary Designs and Cost Estimates, June 1989.

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6. Grice Engineering, Inc., Preliminary Evaluation of the Embankment Site and Reservoir Area for Cañada Reservoir, Phase 1A, July 1989.

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20. Geomatrix Consultants, Evaluation of Seismic Design Criteria, New San Clemente Dam, May 1985.

21. Converse Consultants, Inc., New San Clemente Project Preliminary Design and Feasibility Study, August 1982.

22. Bechtel Corporation, 1992, op. cit.

23. Ibid.

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26. Norman Janke Associates, July 1989, op. cit.

27. Bechtel Civil, Inc., June 1989, op. cit.

28. Dames & Moore, 1989, op. cit.

29. Brown and Caldwell Consultants, July 1990, op. cit.

30. Ibid.

7. HYDROLOGY AND WATER QUALITY

7. HYDROLOGY AND WATER QUALITY

7.1 SETTING[1]

Several hydrologic features could be affected by the project alternatives. They include the surface and groundwater resources of the Carmel Valley and the groundwater resources of the Seaside area.

7.1.1 CARMEL RIVER BASIN

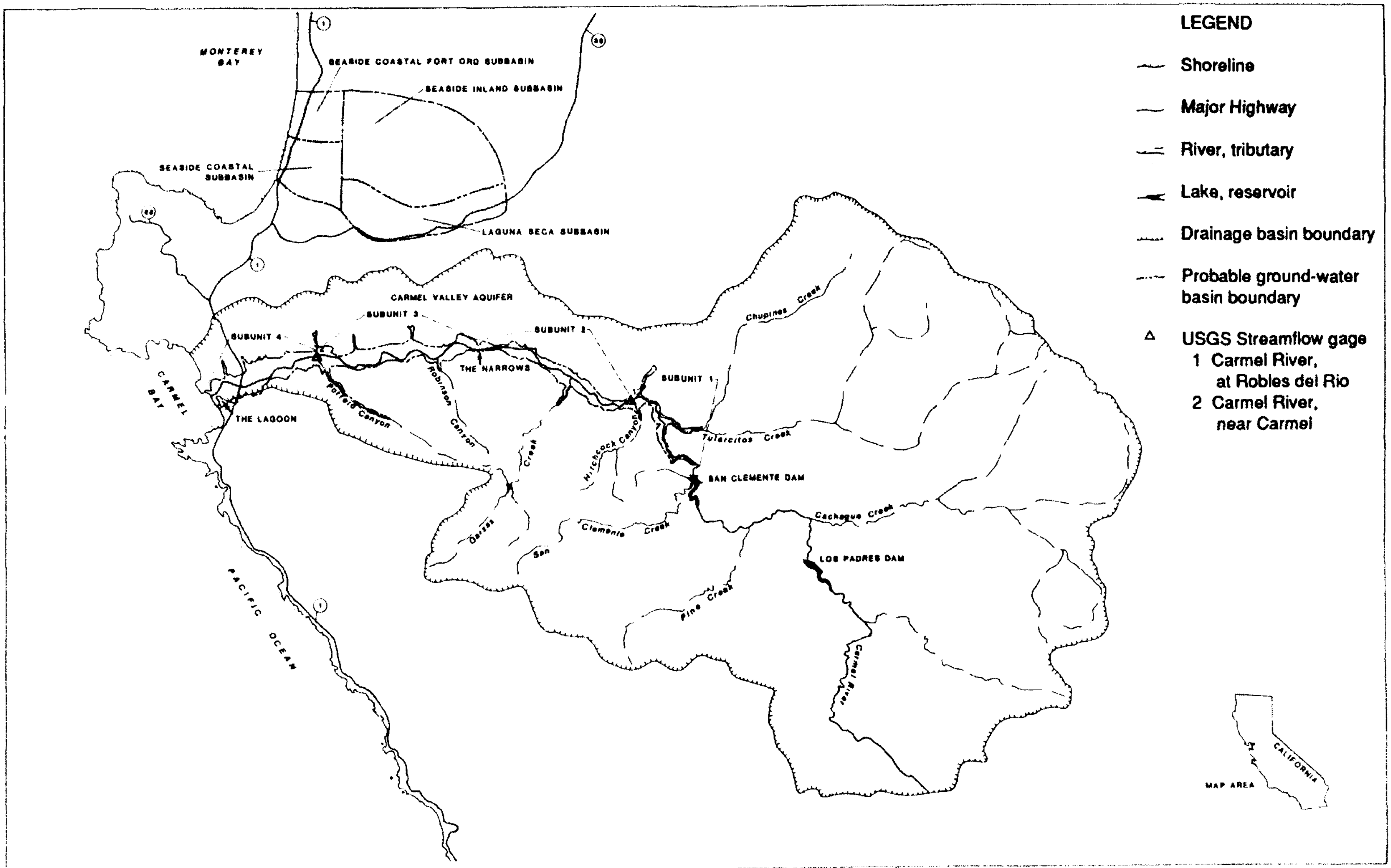
The Carmel River drains a 255 square-mile watershed in the Santa Lucia range. In the upper watershed, the river and its tributaries flow in deep, steep-sided canyons. For its last 15 miles, the river flows across the relatively flat Carmel Valley floor to the Pacific Ocean. Figure 7-1 shows the Carmel River and its principal tributaries.

Streamflow

Rainfall occurs over the watershed primarily between November and April. The first winter rains replenish soils that have dried out during the summer; consequently, little runoff occurs until December. Early runoff from the upper watershed refills Los Padres and San Clemente Reservoirs, which have been drawn down during the preceding months. After filling the reservoirs, usually by mid-December, water overflows to the lower river. Because groundwater pumping has lowered the water level in the aquifer subunits that lie below the lower river, most of these early flows percolate into the ground, depleting flow in the river. When groundwater levels have risen, the period of highest streamflow begins, usually occurring from January through April. Average monthly flows of 200 to 400 cubic feet per second (cfs) occur at this time. When the first of the large flows reaches the lagoon at the river mouth, the storm waters cross the sand barrier that separates the lagoon from the ocean, and the flow to the ocean begins. A channel is bulldozed through the sand barrier by the Monterey County Public Works Department in anticipation of the large flows, in order to reduce the risk of flooding.

PLAN OF CARMEL RIVER AND TRIBUTARIES

FIGURE 7-1



SOURCE: MPWMD

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After the rain stops, the river recedes. Ocean waves then close the channel through the beach, and the lagoon forms again. Usually the river dries up in the lower valley (below the Narrows) by July. From July until the rains begin, the only water remaining in the lower river is in isolated pools that gradually dry up as the groundwater table declines in response to pumping.

Flow in the river is measured continuously at two locations by the U.S. Geological Survey – three river miles from the mouth, near Carmel, and 15 river miles from the mouth at Robles del Rio, adjacent to Esquiline Road (Rosie's) Bridge near Carmel Valley Village. Average monthly flows in the river at Robles del Rio and near Carmel under unimpaired conditions and under existing conditions are shown in Table 7-1. Unimpaired conditions refer to natural conditions that existed in the basin prior to water supply development. Unimpaired flows represent the flows that would have occurred over time without any surface water diversion, groundwater pumpage or reservoir effects (i.e., flow regulation and evaporation). The unimpaired flows for the Carmel River mainstem sites were calculated by adding the reconstructed mainstem flows and estimated tributary flows in a downstream order. No adjustments were made for losses due to groundwater percolation or riparian evapotranspiration. Streamflow in the Carmel River is "flashy," that is, it responds rapidly to rainfall over the watershed. Peak flows vary greatly from year to year as indicated in Table 7-2.

Table 7-3 shows monthly unimpaired streamflow at San Clemente Dam for selected exceedance frequencies. Exceedance frequency refers to the number of times that a particular value will be equalled or exceeded during a specific series of events. For example, the 87.5 percent exceedance frequency means that 87.5 percent of the simulated streamflow values are equal to or greater than a particular flow value. More specifically, the 87.5 percent exceedance frequency for unimpaired streamflow in January at San Clemente Dam is 1,400 acre-feet. This means that the flow in January is equal to or greater than 1,400 acre-feet 87.5 percent of the time.

In general, there is an inverse relationship between exceedance frequencies and streamflow. That is, high exceedance frequencies are associated with low flows and low exceedance frequencies are associated with high flows. This relationship follows from the fact that low flows are frequently exceeded and high flows are infrequently exceeded. Commonly, the observed frequencies are fitted to a theoretical probability distribution and used to assign probabilities of occurrence for specific streamflows. In this analysis, the exceedance frequencies were calculated based on the values simulated for the 1902 to 1991 period. These simulated frequencies were used to indicate the likeli-

TABLE 7-1

AVERAGE MONTHLY FLOWS IN CARMEL RIVER
(Acre-Feet)

	At Robles del Rio Site		At "Near Carmel" Site	
	Unimpaired Conditions[1]	Recorded Conditions[2]	Unimpaired Conditions[1]	Recorded Conditions[3]
October	400	117	400	59
November	1,700	891	1,800	668
December	5,500	3,687	5,900	4,163
January	12,500	10,205	13,500	13,210
February	16,900	15,769	18,300	17,080
March	17,200	16,277	18,600	18,242
April	9,700	10,292	10,500	10,856
May	3,800	3,368	4,100	4,189
June	1,600	975	1,700	1,080
July	600	302	700	243
August	300	87	300	45
September	200	74	200	17
TOTAL	70,400	62,044	76,000	69,852

1 Estimated unimpaired runoff assuming no surface or groundwater development as reconstructed by MPWMD. Based on period 1902 to 1991.

2 Average of USGS gage records at Robles del Rio, 1958 to 1991.

3 Average of USGS gage records near Carmel, 1962 to 1991.

Source: MPWMD.

TABLE 7-2

ANNUAL MAXIMUM FLOWS, CARMEL RIVER, 1958-1991
(Peak Discharge in Cubic Feet per Second)

Water Year	San Clemente Dam Spill[1]	Carmel River at Robles Del Rio	Carmel River near Carmel
1958	10,900	12,500[2]	--
1959	2,530	2,500	--
1960	830	838	--
1961	220	22	--
1962	2,570	2,490	--
1963	7,670	4,950	7,360
1964	1,240	995	800
1965	1,240	1,220	1,620
1966	750	594	774
1967	5,950	4,750	7,420
1968	110	224	140
1969	7,900	6,900	8,620
1970	2,800	3,120	3,500
1971	900	1,170	670
1972	276	278	122
1973	2,410	3,110	5,520
1974	1,620	2,760	2,410
1975	2,190	4,740	4,300
1976	29	81	4
1977	13	34	0
1978	4,440	7,030	7,360
1979	853	1,140	1,340
1980	4,300	5,290	5,880
1981	1,140	2,320	2,133
1982	3,760	5,250	5,560
1983	6,385	8,380	9,590
1984	2,516	3,390	3,150
1985	347	937	637
1986	4,160	4,280	6,680
1987	1,617	2,120	941
1988	230	412	0
1989	230	309	0
1990	608	1,230	134
1991	1,667	2,730	1,970

1 Discharges based on spillway rating curve developed by the U.S. Army Corps of Engineers.
2 Corps of Engineers' estimated value.

Sources: U.S. Army Corps of Engineers, 1974; USGS publ. values; Cal-Am measurements and ratings.

TABLE 7-3

UNIMPAIRED MONTHLY STREAMFLOW VALUES FOR SELECTED EXCEEDANCE FREQUENCIES FOR THE CARMEL RIVER AT SAN CLEMENTE DAM
(All Flow Values are in Acre-Feet)

	Frequency				
Month	12.5	25.0	50.0	75.0	87.5
October	700	500	300	100	100
November	3,200	1,400	700	300	200
December	13,400	5,500	2,300	1,000	600
January	25,700	15,700	5,900	2,400	1,400
February	41,300	24,400	9,600	3,900	2,300
March	33,900	22,500	11,500	4,200	3,100
April	18,500	10,000	5,800	2,500	1,700
May	7,200	4,300	2,900	1,400	800
June	3,300	2,200	1,100	600	300
July	1,400	800	400	100	100
August	500	300	100	100	100
September	400	200	100	100	100

Note: Percent values refer to exceedance frequencies. For example, monthly flow in January is equal to or greater than 1,400 acre-feet 87.5 percent of the time.

Exceedance frequencies were calculated based on the unimpaired monthly record for the Carmel River at San Clemente Dam that was reconstructed by MPWMD for Water Years 1902-1991.

Source: MPWMD

hood that certain flows would occur with the specified projects and associated operations. It was assumed that future inflows would be statistically similar to the historical record.

In the CVSIM analyses, water years were classified based on selected exceedance frequencies. In general, five classes – wet, above normal, below normal, dry, and critically-dry -- were defined based on the 25.0, 50.0, 75.0, and 87.5 exceedance frequencies, respectively. Table 7-4 shows a breakdown of the annual unimpaired flows at San Clemente Dam by water year type based on these thresholds. This type of frequency analysis was incorporated into CVSIM so that all output (e.g. streamflow, storage, production, etc.) was expressed according to the selected exceedance frequencies. The statistically-derived water year classes were used to represent typical "wet", "normal", and "dry" conditions, rather than specific years. This approach was taken (1) to minimize the bias that would be introduced by analyzing single years and (2) to clearly discern differences in project performance and impacts over the long term.

Existing Water Resources Development

There are presently two dams on the Carmel River: San Clemente Dam and Los Padres Dam (see Figure 7-1). Both dams are owned and operated by Cal-Am. San Clemente Dam is located near the confluence with San Clemente Creek about 18 miles from the river mouth. The dam is 85 feet high and was completed in 1921. When the dam was built, the reservoir it formed had a capacity of 2,136 acre-feet (AF) which has since been reduced to about 800 AF (flashboards raised) by sediment washing into the reservoir from the upper watershed.

Los Padres Dam, completed in 1949, is 148 feet high and is located about 25 miles from the river mouth. Its original reservoir capacity of 3,030 AF has been reduced to about 2,180 AF by accumulated sediment.

The dams are operated conjunctively to regulate streamflow and to supply water to users on the Monterey Peninsula via the Carmel Valley Filter Plant. No flood control storage is allocated in either reservoir, although some minor flood control benefits may be attributable to the dams early in the flood season, when storage space is available as a result of summer drawdown for water supply and instream flow releases. The dams have little effect on peak flows downstream later in the flood season, when the reservoirs are full.

TABLE 7-4

BREAKDOWN OF ANNUAL UNIMPAIRED FLOWS AT SAN CLEMENTE DAM
BY WATER YEAR TYPE BASED ON
SELECTED EXCEEDANCE FREQUENCIES

Water Year Type	Exceedance Frequency (%)	Streamflow (Acre-Feet)
Wet	> 25.0	> 103,400
Above Normal	25.0 - 50.0	50,600 - 103,400
Below Normal	50.0 - 75.0	27,500 - 50,600
Dry	75.0 - 87.5	15,200 - 27,500
Critically Dry	< 87.5	< 15,200

Note: Percentiles are based on exceedance frequencies. For example, a dry year would occur when flows at San Clemente Dam were exceeded between 75.0 and 87.5 percent of the time (i.e., between 15,200 and 27,500 acre-feet). Frequencies were derived from the long-term (1901-1991) reconstructed flow record at San Clemente Dam.

Source: MPWMD

Los Padres Dam is operated by Cal-Am to maintain as much water as possible in San Clemente Reservoir and to meet a streamflow requirement of 5 cfs below Los Padres Dam. San Clemente Dam is operated by Cal-Am in accordance with a Memorandum of Agreement (MOA) that is developed each year by Cal-Am, the District, and CDFG. The MOA is designed to maximize releases from San Clemente Reservoir to maintain rearing habitat for juvenile steelhead in the area between the Narrows and San Clemente Dam.

Storm Flow, Channel Geometry and Bank Erosion

The portion of the Carmel River downstream of San Clemente Dam is an alluvial river, which is a river that flows over an accumulation of sediment deposited and reworked by the river in an earlier time. This means that the shape and character of the river channel are mainly determined by erosion and deposition of sediment transported by the flow. In an alluvial river, if the flow increases, the channel erodes, becoming deeper and wider to accommodate it. If the flow decreases, sediment is deposited and the channel decreases in size.

Although alluvial rivers are naturally unstable, continuously changing in time and space, a dynamic equilibrium is established over a period of many years; this natural balance can be disturbed by man's activities, as has occurred in the Carmel River.

Before European settlement, the Carmel River was in a state of dynamic equilibrium. Periodically, extremely large floods would deposit large quantities of sediment in the lower reaches of the river. In the succeeding years, the river would gradually cut down into the sediments, forming an incised, meandering channel until a great flood again altered the channel by massive sediment deposition.

Large floods occurred on the Carmel River in 1862, 1890, 1911 and 1914. In 1921, during the early stages of the natural cycle of adjustment to the 1911 flood, San Clemente Dam was completed. While this new dam prevented almost all the bedload from reaching the lower river, it was too small to substantially reduce the peak flows. Bedload is that portion of the sediment that moves downstream by rolling and bouncing along the bottom rather than being suspended in the flow. Bedload consists of coarse sands, gravels and boulders. The suspended portion of the sediment, known as suspended load, consists of fine sands, silts and clays.

The undiminished flood flows below San Clemente Dam, devoid of bedload and consequently no longer in equilibrium with the channel characteristics, began to erode material from the river bed and banks, in search of a new equilibrium. In the river reach immediately below the dam, fine river bed materials were washed out, leaving only coarse materials which prevented further erosion of the river bed except during the largest floods. This phenomenon, which commonly occurs below dams, is called armoring.

Farther downstream, the Carmel River adjusted to the loss of bedload material by deepening its channel. As the channel deepened or incised, more of the flood flows were confined to the channel itself, rather than spreading over the floodplain. This increased the speed of water flow and the rate of bank erosion, although erosion was limited by the growth of riparian vegetation. As the river incised between 1921 and the early 1960s, an extensive riparian forest developed protecting the banks from erosion, except at bends. By about 1940, the river channel had adjusted to the presence of San Clemente Dam and a new dynamic equilibrium had been established.

In the mid- and late 1970s, a considerable amount of riparian vegetation was lost as the 1976-77 drought and groundwater pumping lowered the water table in parts of the valley. With the banks unprotected by riparian vegetation, the river adjusted to flood flows by eroding both the channel bed and the banks. After the storm flows passed, the eroded materials were redeposited in the channel bed. As a result of this process, a middle reach of the river, between the Garland Ranch Regional Park and Schulte Road, has changed drastically from a narrow, deep, meandering channel with well-developed riffles and pools to a wide, shallow channel with eroded banks and an unstable bed.

Carmel River Lagoon

A naturally occurring lagoon and wetlands area exists at the mouth of the Carmel River, where the river flows to the Pacific Ocean at Carmel Bay (see Figure 7-1). This area represents one of the few remaining estuary/wetlands areas in California. About 90 percent of California's wetlands acreage has disappeared during historical time due to development encroachment, reduction in water supplies, dredging, etc.

Surface flow from the Carmel River into the lagoon normally recedes after the rainy season in late spring, and ceases between June and August as rates of water extraction from the river and alluvial

aquifer exceed baseflow discharge. River flow into the lagoon normally resumes again between November and January with the onset of the rainy season.

The mouth of the lagoon closes when inflow declines to several cubic feet per second (cfs), and a large sandbar builds up on the beach due to wave action during the summer months. When inflow resumes at the onset of the rainy season, the Monterey County Public Works Department must at times manually breach the sandbar prior to when storm flow would naturally breach it, in order to prevent flooding of homes at the northern terminus of the wetlands area. The Monterey County Public Works Department has completed a draft interim emergency breaching plan and coordinates this effort with various federal, State and local regulatory agencies.

The surface area of the lagoon is usually about six acres during the summer when the mouth is closed, and expands to about 50 acres when the lagoon rises to flood adjacent wetlands, before the sandbar is breached. After the mouth is opened, the surface area of the lagoon varies with the tide, the discharge in the river, and the location of the mouth, but is roughly equivalent to the summertime area except during very high flows.[2]

During the summer and fall, the sandbar at the mouth blocks the connection with the ocean, resulting in a brackish mixture of trapped sea water and fresh water from the river and groundwater. A hydrogeologic study in the coastal portion of the Carmel Valley alluvial aquifer indicated that the lagoon is likely supplied in part by groundwater inflow.[3] Some sea water probably seeps through the beach sands during summer, but for the most part the salinity of the lagoon remains low until fall. Usually in September or October, higher tides occur and the sandbar is overtopped by waves, resulting in an increase in the salinity and surface area of the lagoon.

The lagoon and wetlands environment is presently being impacted in four key areas. First, the diversion of water, for private and municipal supply, from the Carmel River and its underlying groundwater basin, reduces fresh water inflow to the lagoon. This loss of inflow diminishes the habitat value of the lagoon for juvenile steelhead by reducing the water surface area, available cover, and the productivity of the remaining habitat.

Second, the artificial breaching of the sandbar at the mouth of the lagoon reduces the frequency and duration of flooding that would naturally occur within the surrounding wetlands. This reduction in

flooding may be responsible for a shift from fresh water to saline water vegetation species in some areas of the wetland.[4] The lagoon water level declines rapidly after breaching of the sandbar, stranding steelhead in the adjacent marsh and pasture lands. In addition, the reduced flooding limits the available feeding area for the fish.

Third, the increased sediment load of the Carmel River in recent years is affecting the suitability of aquatic habitat in the main body of the lagoon, particularly for steelhead. The latest cycle of erosion and sediment transport is directly related to channel bank instability in the middle and lower reaches of the river.

Fourth, the southern arm of the lagoon has filled with sediment and vegetation in recent years, thereby reducing the habitat value in this area of the lagoon. The south arm has in the past been an excellent refuge for steelhead due to its deep channel and protective cover.

Potential mitigation measures for each of the above problems have been identified as part of the Carmel River Lagoon and Wetlands Enhancement Plan. This enhancement plan results from the efforts of the Carmel River Steelhead Association to implement an agreement for funding the plan between the California State Parks Department, the California Coastal Conservancy, the Monterey County Water Resources Agency (formerly the Monterey County Flood Control and Water Conservation District), and the Monterey Peninsula Water Management District.

Beaches[5]

Coastal beaches are formed by sediments washed into the ocean by rivers. Any activities that alter the sediment load carried by rivers have the potential to affect beach formation and replenishment.

The Carmel River enters the Pacific Ocean within Carmel Bay. Carmel Bay is enclosed by two rocky headlands: Pescadero Point on the north and Point Lobos on the south. It is approximately 3 miles long and 2.5 miles wide with a shoreline consisting of rocky outcrops interspersed with small sandy coves. The head of a deep submarine canyon, the Carmel Canyon, penetrates the Bay. Examination of aerial photographs taken over the last 32 years indicates that the Carmel Bay beaches are in a state of equilibrium, neither increasing nor decreasing in size.

Carmel River Water Quality

The quality of surface water in the upstream reaches of the Carmel River is considered good because the flow originates from an undeveloped, predominantly granitic watershed. The quality of the water in residence in Los Padres Reservoir can be seasonally low in dissolved oxygen. Small concentrations of dissolved hydrogen sulfide have also been detected near the bottom of the reservoir. This does not affect the suitability of the water for potable consumption, but can affect aquatic life in and downstream of the reservoir. An aeration system installed by Cal-Am operates in the reservoir during summer months to reduce any deleterious water quality effects on aquatic life. No water quality problems have been detected downstream at San Clemente Reservoir, where an aeration system also operates seasonally.

Water from tributary streams draining the sedimentary rock formations on the north side of Carmel Valley below San Clemente Reservoir is generally higher in dissolved solids content and some trace metals. The ranges of observed values reported by the U.S. Army Corps of Engineers for selected water quality parameters both above and below San Clemente Dam are shown in Table 7-5. The highest mineral concentrations are generally observed during low flow periods.

7.1.2 CARMEL VALLEY AQUIFER

Groundwater Hydrology

The principal water-bearing geologic formation in the Carmel Valley is the younger alluvium, consisting of poorly consolidated boulders, gravel, sand and silt deposited by the Carmel River in the last 10,000 years. The thickness of the alluvium increases in a downstream direction from zero above the Carmel Valley Filter Plant, to more than 200 feet west of Highway 1 near the river mouth, with a typical thickness of 50 to 100 feet. The Carmel Valley aquifer is unconfined and is highly permeable, recharging rapidly after extended dry periods. The aquifer is underlain by much less permeable bedrock formations consisting of pre-Tertiary age igneous and metamorphic rocks, and Tertiary age sedimentary rocks. Only a few wells on the valley floor have been drilled through the alluvial sediments into underlying bedrock. Because the permeability of these rocks is considerably less than the alluvial sediments, groundwater exchange with the alluvium is assumed to be limited. The aquifer can be divided into four subunits: subunits 1 and 2 are collectively referred to as the upper aquifer, and subunits 3 and 4 are referred to as the lower aquifer (Figure 7-1). It should be

TABLE 7-5

RANGE OF WATER QUALITY PARAMETERS[1]
CARMEL RIVER BASIN

Quality Parameter	Above San Clemente Dam	Below San Clemente Dam	Carmel Valley Aquifer Water
Conductivity	10-500 μmhos	100-2,000 μmhos	250-3,300 μmhos[2]
pH	7-8.5	7-8.5	6.5-8.5
Iron (Fe)	0.1-3 mg/l	0.1-80 mg/l	0.1-40 mg/l
Manganese (Mn)	0-0.1 mg/l	0-0.1 mg/l	0.6 mg/l
Phosphate (PO_4)	–	0-1.4 mg/l	–
TDS	50-300 mg/l	50-1,500 mg/l	200-1,000 mg/l
Boron (B)	0-0.3 mg/l	0-0.3 mg/l	0-0.2 mg/l
Nitrate (NO_3)	0-1 mg/l	0-5 mg/l	0-18 mg/l[2]
Sulfate (SO_4)	5-100 mg/l	5-500 mg/l	20-600 mg/l
Chloride	5-20 mg/l	10-300 mg/l	20-300 mg/l
Dissolved Oxygen	7-13 mg/l	7-13 mg/l	–
Turbidity	0-200 NTU	0-200 NTU	–

1 U.S. Army Corps of Engineers, Feasibility Report, 1981, unless otherwise noted.
2 MPWMD monitoring well network in the Carmel Valley Aquifer.

noted that the terms "upper" and "lower" refer to upstream and downstream regions; the terms do not refer to shallow versus deep aquifer zones. A map and profile of the Carmel Valley Alluvial Aquifer is shown in Figure 7-2. This figure shows the location of Cal-Am's production wells in the Carmel Valley.

About 85 percent of the water entering the aquifer percolates through the bed of the Carmel River.[6] Additional recharge comes from the tributary drainages, direct infiltration of precipitation, inflow from subsurface bedrock formations and return flow from irrigation and septic systems. Water in the aquifer is primarily lost by groundwater pumping; minor sources of loss include discharge into the river, seepage into the ocean, evapotranspiration by riparian vegetation and deep percolation into underlying strata.

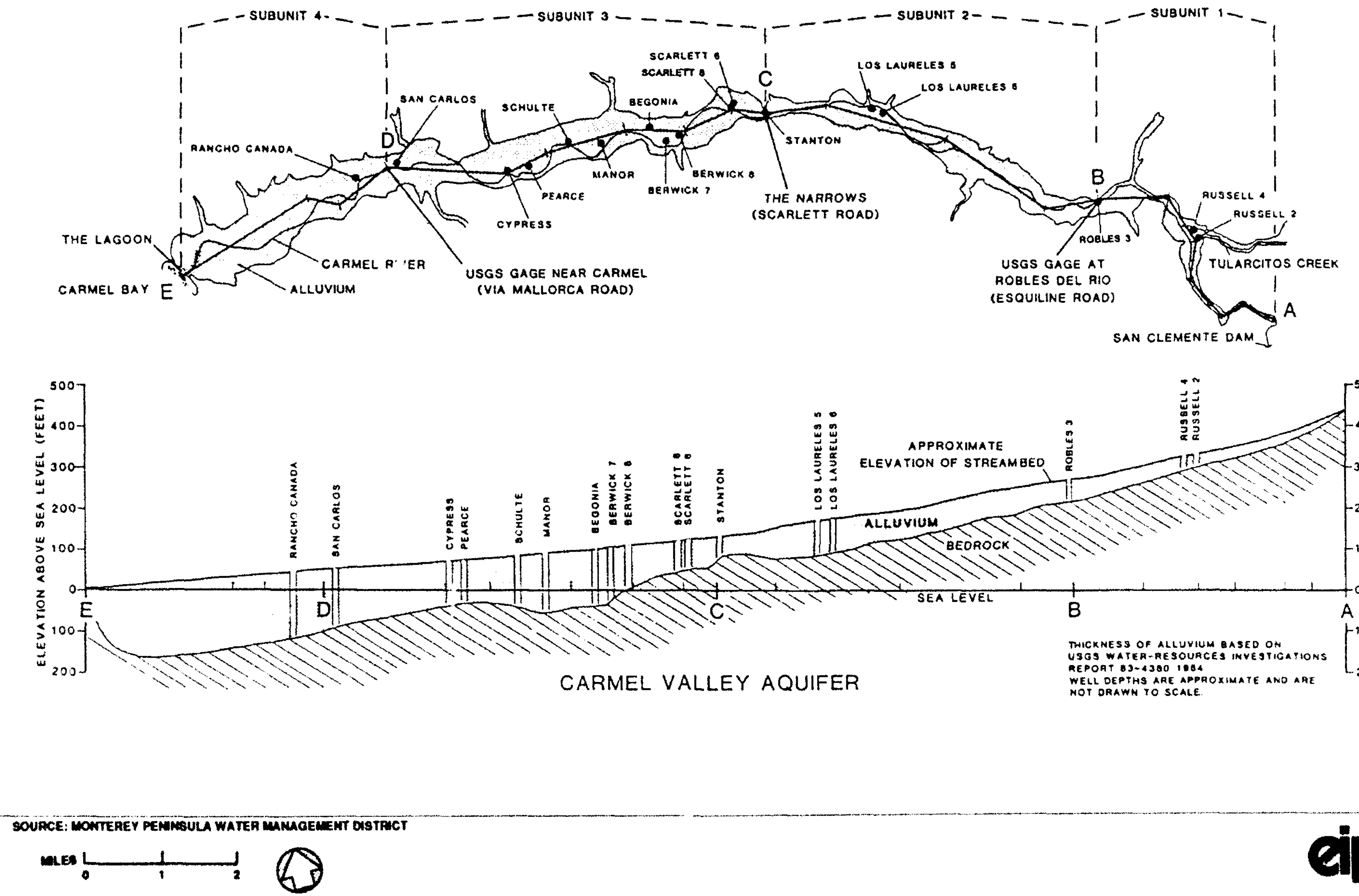
Although riparian vegetation was much more abundant before the valley was developed and, consequently, evapotranspiration was greater, the water level in the aquifer in the summer and fall was generally high enough to provide base flow to the river and sustain year-round flow. Upstream diversion of water and large-scale groundwater pumping now dry up the river in the lower Carmel Valley during the summer months.

Prior to 1985, Cal-Am withdrew about 45 percent of its water from wells in the Carmel Valley and Seaside aquifers. In April 1985, the District enacted an ordinance that limited Cal-Am surface water diversion from San Clemente Reservoir, and required that Cal-Am produce at least 71 percent of its water supply from these wells. During the last pre-drought year, Cal-Am wells withdrew 8,440 AF from the alluvial aquifer, and non Cal-Am wells withdrew 2,310 AF, for a total of 10,750 AF (MPWMD well records for Reporting Year 1986-87). A portion of the non Cal-Am pumpage is assumed to return to the aquifer as recharge coming from irrigation and septic system return flow.

The volume of groundwater storage in the Carmel Valley aquifer is a function of the geometry of the basin and the porosity of the alluvial sediments. Based upon available information from logs of existing wells in the basin, the total groundwater storage capacity of the aquifer is estimated by the District to be approximately 48,000 AF. Groundwater storage capacity estimates have been made by other investigators based on varying amounts of information, and have generally been in the range

PROFILE OF ALLUVIAL AQUIFER SHOWING CALIFORNIA-AMERICAN WATER COMPANY PRODUCTION WELLS

FIGURE 7-2



SOURCE: MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

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of 36,000 to 52,000 AF. Not all of the total storage volume is considered usable, however, as this would result in complete dewatering of the aquifer. This would not be desirable or even possible, given the present configuration of production wells.

For CVSIM modeling purposes, the total groundwater storage capacity of the aquifer has been adjusted to exclude non-usable storage below the bottom of the perforations of the Cal-Am wells, and in the lower portion of the aquifer that provides subsurface outflow to the ocean for prevention of sea water intrusion and fresh water inflow to the lagoon to minimize adverse impacts to the lagoon and wetlands environment. The volume of usable groundwater storage in the aquifer is estimated at 28,500 AF. The total and usable storage capacities in each of the aquifer subunits are summarized in Table 7-6.

Groundwater Quality

The quality of groundwater in the Carmel Valley aquifer generally reflects that of the river in terms of the relative concentration of the major inorganic constituents, but is somewhat more mineralized. The dissolved mineral content of the groundwater increases from upstream to downstream locations in the aquifer. As shown in Table 7-7, the average Total Dissolved Solids concentration increases from less than 300 milligrams per liter (mg/L) in aquifer subunit 1 to greater than 600 mg/L in aquifer subunit 4. This is due to the longer groundwater residence time, which allows for greater chemical dissolution of the aquifer sediments in contact with the groundwater, and to the variable composition of the aquifer sediments. The ranges of observed values for selected water quality parameters for the Carmel Valley aquifer are shown in Table 7-5. Groundwater pumped from the aquifer above the Narrows requires no special treatment prior to municipal use. Groundwater pumped from the aquifer downgradient from the Narrows requires minor treatment for excessive iron and manganese concentrations prior to municipal supply use.

There has been some concern about the potential for groundwater quality degradation (particularly from nitrates) of the Carmel Valley aquifer from overlying septic systems that exist on the valley floor. This concern prompted the District to establish a groundwater quality monitoring program in 1981. This program was designed to track water quality trends in the shallow zones of the alluvial aquifer to serve as an early warning of possible contamination that could affect the deeper water supply wells in the valley.

TABLE 7-6

TOTAL AND USABLE STORAGE CAPACITIES
CARMEL VALLEY AQUIFER SUBUNITS

	Storage Capacity in Acre-Feet		
Subunit[1]	Total	Non-Usable	Usable
AQ1	2,029	0	2,029
AQ2	6,099	1,597	4,502
AQ3	19,615	2,688	16,927
AQ4	20,475	15,475	5,000
Total	48,218	19,760	28,458

[1] AQ1 refers to the alluvial area below San Clemente Dam to the USGS Robles del Rio gaging station, upstream of Esquiline Bridge. AQ2 refers to the alluvial area from the USGS Robles del Rio gaging station to the "Narrows," near Cal-Am's Stanton well. AQ3 refers to the alluvial area from the Narrows to the USGS near Carmel gaging station, upstream of Via Mallorca Bridge. AQ4 refers to the alluvial area from the USGS near Carmel gaging station to the mouth of the Carmel River.

Source: Monterey Peninsula Water Management District

TABLE 7-7

WATER QUALITY SUMMARY OF SELECTED CALIFORNIA-AMERICAN WATER COMPANY WELLS IN THE CARMEL VALLEY AQUIFER

Sample Location	Number of Samples	Total Dissolved Solids (milligrams/liter) Mean	Range
Carmel River			
CV Filter Plant	13	256	154-354
Aquifer Subunit 1			
Russell #4 Well	6	257	224-329
Aquifer Subunit 2			
Laureles #6 Well	5	399	344-444
Aquifer Subunit 3			
Scarlett #8 Well	10	432	378-472
Schulte Well	15	512	312-692
San Carlos Well	10	668	480-1176
Aquifer Subunit 4			
Cañada Well	10	641	528-828

Notes:

Water quality data from California-American Water Company.

Total Dissolved Solids concentrations for CV Filter Plant, Russell #4, Laureles #6, Scarlett #8 were calculated by multiplying Specific Conductance by 0.75.

Source: Monterey Peninsula Water Management District

The results from this ongoing monitoring program indicate that, typically, there is a seasonal fluctuation of water quality in the shallow zones of the aquifer, presumably related to flushing of the overlying unsaturated soils subsequent to winter storm periods. However, all analyses from the alluvial aquifer through 1992 indicate that water quality is well within established water quality standards with no clearly discernible long-term trend of deteriorating water quality. This conclusion was confirmed when the District commissioned a groundwater quality evaluation in 1991 to address concerns about threat of increased nitrate levels in the upper valley (i.e., above the Narrows) during the recent drought period.[7]

A groundwater pollution study in the Carmel Valley Village area was conducted for the Monterey County Health Department in 1986.[8] This study indicated similar results in that low, but detectable nitrate concentrations were identified in the alluvial aquifer. The lack of nitrate buildup was attributed to the presence of course alluvial sediments that allowed rapid dilution of septic system effluent when the aquifer was flushed during recharge events. These results notwithstanding, the District's monitoring program was expanded in late 1989 to more closely track any possible water quality changes attributable to the recent drought period.

In early 1989, the District installed a series of monitor wells near the coast as part of a hydrogeologic investigation of the coastal portion of the Carmel Valley aquifer.[9] These monitor wells have been integrated into the District's network, and are being used to collect baseline water quality data from the coastal area of the aquifer. Water quality results from these wells indicate that a mixing zone of fresh water and seawater exists at the mouth of the valley near the Carmel River State Beach, but no seawater intrusion into the freshwater aquifer system is indicated. The potential for seawater intrusion into inland areas may be limited by uplift along the Cypress Point fault at the mouth of the valley, which has constricted the opening of the alluvial aquifer at the seashore to a narrow gap, approximately 500 feet wide by 100 feet deep.

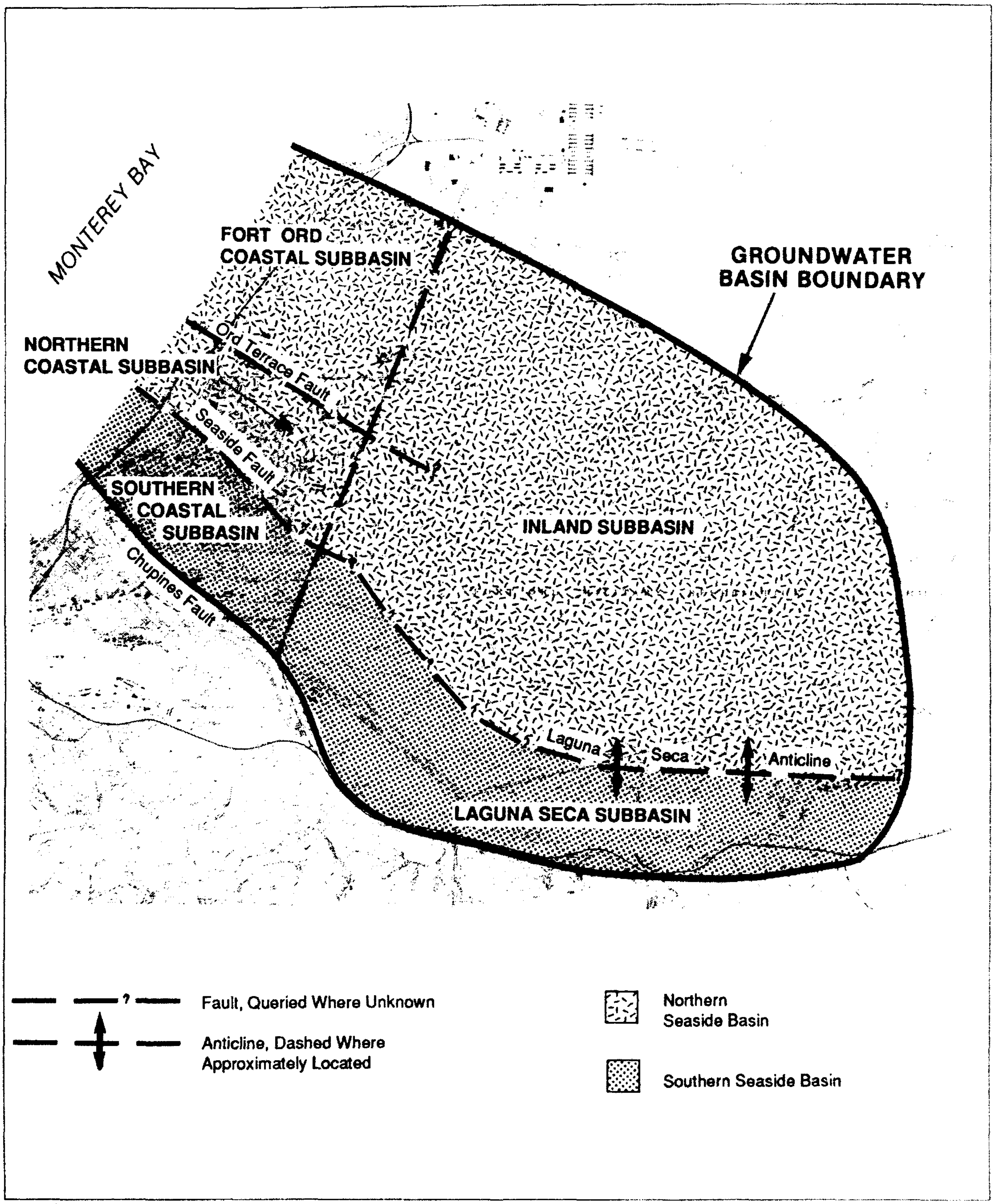
7.1.3 SEASIDE GROUNDWATER BASIN

Groundwater Hydrology

The Seaside groundwater basin encompasses approximately 24 square miles below the City of Seaside and Fort Ord Military Reservation as shown in Figure 7-3. The water-bearing strata are the Santa

SEASIDE GROUNDWATER BASIN BOUNDARIES

FIGURE 7-3



SOURCE: U.S.G.S. SEASIDE, SPRECKELS, MARINA AND SALINAS 7 1/2" QUAD SHEETS; STAAL, GARDNER & DUNNE, INC. (19[illegible]).

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Margarita Sandstone, the Paso Robles Formation, the Aromas Sand and the older dunes, with a total thickness greater than 900 feet in places. The Seaside groundwater basin has been divided into a northern and southern basin, and a number of subbasins.[10] The Southern Seaside Basin is defined as the area bounded by the northwest-trending Laguna Seca Anticline to the north, and the Chupines Fault to the south. This basin is subdivided into the Southern Seaside Coastal Subbasin and the Laguna Seca Subbasin. The Northern Seaside Basin constitutes the remaining portion of the overall Seaside Basin, that is, the area north of the Laguna Seca Anticline. The Northern Seaside Basin is further subdivided into the Northern Seaside Coastal, Northern Seaside Inland, and Fort Ord Subbasins. Recharge of the groundwater basin occurs as infiltration of rain, subsurface flow from adjacent areas and seepage from streams. Groundwater is lost from the basin by pumping and by discharge to the ocean.

No groundwater is currently extracted from the Northern Seaside Inland Subbasin underlying Fort Ord. Results of a recent monitoring well drilling investigation indicate that the groundwater development potential in this area to meet the water supply needs of the Monterey Peninsula is poor.[11]

Groundwater from the Northern and Southern Seaside Coastal Subbasins are currently extracted by Cal-Am, the City of Seaside and private users. Long-term yield of the Seaside coastal subbasin is estimated at 4,940 AF/year, with yield to the Cal-Am system expected to be about 3,750 AF/year. The subbasin is capable of periodically meeting demands substantially greater than the estimated long-term yield without negative impacts; however, groundwater extractions need to be correspondingly reduced at other times to avoid overall storage depletion and possible seawater intrusion. The coastal subbasins' ability to meet demands of as much as 5,000 AF/year for several years without negative impacts on water quality was demonstrated during the 1970s.

Groundwater Quality

Groundwater quality in the coastal portion of the Seaside Basin is more variable than in the Carmel Valley aquifer. This is due to the variable lithologic makeup of the aquifer system and relatively longer residence time of the groundwater in contact with aquifer sediments. Although available water quality data from the Seaside Basin is somewhat limited, a general pattern exists in water quality from the two principal aquifer units, the Paso Robles Formation and the Santa Margarita Sandstone.

Groundwater from the Paso Robles Formation is generally of a sodium-calcium-chloride to a sodium-chloride chemical character with total dissolved solids in the range of 300 to 600 milligrams per liter (mg/L). The upper part of the Paso Robles Formation is somewhat lower in total dissolved solids and often displays higher nitrate concentrations (ranging from 3 to 10 mg/L as nitrogen) than the lower part of the Paso Robles Formation. The lower dissolved solids and relatively higher nitrate concentrations suggest a more local source of recharge and possibly some component of return flows from landscape irrigation.[12]

Groundwater quality from the underlying Santa Margarita Sandstone is more chemically variable and more mineralized than the Paso Robles Formation, with total dissolved solids concentration generally in the 600 to 800 mg/L range. Groundwater from the Santa Margarita Sandstone may contain elevated levels of manganese ions and low levels of hydrogen sulfide gas in places.[13]

7.1.4 MONTEREY BAY

Oceanography

The character of seawater in the vicinity of Monterey Bay is influenced by large-scale water movements in the northern Pacific Ocean. Waters in the Subarctic and North Pacific water masses are carried into the area by the southward flowing California Current. This current is actually the eastern edge of the large clockwise permanent Pacific Ocean gyre consisting of the North Equatorial Current, the Kuroshio Current off Japan, the Aleutian Current south of the Aleutian Islands, and the California Current.[14]

The coastal waters are cool, as might be expected considering their northern origin. Periods of minimum water temperature often occur in the spring, when upwelling takes place. Upwelling is a phenomenon caused by strong winds that drive surface waters away from the coast. Cold, nutrient-rich waters from the bottom of the ocean rise, replacing the surface waters and stimulating abundant biological growth. The highest water temperatures usually occur in August and September, when upwelling ceases and the waters are warmed by solar heating. From November to February, the effects of the Davidson Current, a weak, warm, northward-flowing current, are usually felt in the area.

Water Quality

Ocean water salinities were observed to vary from 33 to 36 parts per thousand (ppt), indicating seasonal trends associated with oceanographic currents.[15] Measured salinities in Monterey Bay were highest in March, declined to a low point in July, and rose again in October. High salinity measurements reflect the intrusion of cold, saline waters upwelling from Monterey Canyon. Turbidity levels also tended to be higher during periods of upwelling and from winter storm wave scouring and sediment resuspension.

Subsurface waters showed lower levels of dissolved oxygen than did surface waters, with a difference of about 2 mg/l most of the time.[16] This is a common occurrence as surface waters are subject to greater aeration because of their exposure to the atmosphere. Total coliform samples were less than 2 MPN/100 ml in all samples, and no fecal coliforms were detected in any sample.

The California Regional Water Quality Control Board (RWQCB), Central Coast Region, is the agency responsible for the protection of nearshore water quality. The RWQCB regulates discharges to the ocean in accordance with the Water Quality Control Plan for Ocean Waters of California, usually referred to as the "Ocean Plan".[17] The Ocean Plan lists a number of uses of ocean waters that must be protected. These uses, known as beneficial uses, include industrial water supply, water contact and non-contact recreation, including aesthetic enjoyment, navigation, commercial and sport fishing, mariculture, preservation and enhancement of Areas of Special Biological Significance, rare and endangered species, marine habitat, fish migration, fish spawning, and shellfish harvesting.

Monterey Regional Water Pollution Control Agency (MRWPCA) Plant

The largest discharge of municipal wastewater to Monterey Bay is the MRWPCA discharge. The MRWPCA provides wastewater treatment services for the Cities of Monterey, Pacific Grove, Del Rey Oaks, Sand City, Seaside, Salinas and Castroville, together with the Seaside County Sanitation District, the County of Monterey, the Moss Landing County Sanitation District, Fort Ord, the Boronda County Sanitation District, and the Marina County Water District. While the MRWPCA treatment plant has a capacity of 29.6 million gallons per day (MGD), the mean effluent discharge rate in 1991 was 18 MGD. The plant provides secondary treatment to wastewater generated from nearly all of northern Monterey County. Discharge of treated wastewater to Monterey Bay occurs through a two-mile long outfall, the last quarter-mile of which contains two-inch diameter diffuser

ports. The treatment plant has been in operation since February 1990, and, with a few minor exceptions, has met nearly all effluent quality requirements.[18]

In the future, it is proposed that a tertiary treatment facility will be brought on-line to reclaim a portion of the effluent for use in irrigation, thereby reducing the flow through the outfall. The probable mode of future operation is 100 percent reclamation during the spring and summer months, with 10 percent to 20 percent reclamation during the fall and winter months.

The outfall diffuser associated with the MRWPCA plant has a total length of 1,368 feet, with ports equally spaced on each side in a staggered configuration. On each side the port separation is 16 feet. The outfall was designed with a total of 172 ports, but currently only 128 are open because the plant is not operating at design capacity. The diffuser spans water depths from 85 to 100 feet, with an average depth of about 98 feet and an average port elevation above the bottom of 2.8 feet. The port diameter is 2 inches, and the ports are all oriented horizontally and perpendicular to the line of the diffuser.

Dilution of effluent discharged from a submerged multiport diffuser takes place in several successive phases.[19] In the first phase, a jet of effluent emerges at high velocity from each of the diffuser ports, usually with a horizontal orientation. The momentum of the discharged fluid dominates the motion in the jet phase. Ambient water is rapidly entrained into the jet, diluting it and slowing it down. As the velocity of the jet decreases, buoyancy forces assert more influence and the jet changes into a plume. For a wastewater discharge, the effluent density is approximately that of fresh water, i.e., about 1000 kg/m^3, compared with a typical seawater density of about 1025 kg/m^3. A wastewater effluent plume is therefore less dense than the ambient seawater, and buoyancy causes the plume to rise. As the plume rises and spreads, with a constantly decreasing velocity, further dilution occurs through the entrainment of ambient seawater. The mixing of denser seawater into the plume causes it to become more dense. In a stratified ocean, the plume may become denser than water in the surface layer. In this case the effluent becomes trapped at a depth, called the "trapping level", at which the buoyancy force goes to zero. If the plume is not trapped, it will rise to the surface.

The dilution achieved in these first two phases is typically of the order of 100:1, and it occurs rapidly, within a matter of minutes. Subsequent dilution of the effluent, now referred to as the waste field, is comparatively slow. Ambient currents, turbulence and wave action transport and disperse the waste

field, but the further dilution obtained in a matter of hours may only be a factor of five or ten. An additional factor influencing the dilution achieved by a multiport diffuser is the interaction of plumes from adjacent ports. Under some conditions, the spreading of the plumes will be such that some mixing between adjacent plumes occurs, causing the dilution to be less than that experienced by an isolated plume.

The dilution achieved in the jet-plume phases (i.e., until the plume is trapped or surfaces) is referred to as the "initial dilution", and the spatial region within which this dilution occurs is called the "zone of initial dilution", or alternatively the "mixing zone". Regulatory requirements for wastewater discharges in the ocean focus on the initial dilution as a quantitative measure of the performance of an outfall. The initial dilution achieved by a multiport diffuser is a function of numerous variables, including the geometry of the diffuser, the density structure of the receiving water, and the density and discharge rate of the effluent. Because it is always expensive and often impractical to conduct field experiments to determine initial dilution, numerical models are used to analyze and predict outfall performance.

7.2 ASSUMPTIONS, METHODS AND STANDARDS OF SIGNIFICANCE

In this section, the key assumptions, methods, and standards of significance used to analyze and assess the hydrologic and water quality impacts from each water supply alternative are described. The CEQA guidelines indicate that a project would normally be considered to have a significant adverse impact on hydrology or water quality if it were to substantially degrade water quality; contaminate a public water supply; substantially degrade or deplete groundwater resources; interfere substantially with groundwater recharge; or cause substantial flooding, erosion or siltation. Specifically, four hydrologic factors are addressed: (1) streamflow in the Carmel River, (2) groundwater storage in the Carmel Valley aquifer and Seaside Coastal Groundwater Basin, (3) flow frequency and channel geometry in the Carmel River, and (4) sediment transport and channel stability in the Carmel River. Each of these factors is discussed below.

7.2.1 STREAMFLOW ANALYSIS

In this analysis, the impacts of each alternative on streamflow in the Carmel River are assessed. Specific attention is given to maintenance of perennial flow. The analysis focuses on monthly streamflow at two mainstem sites on the Carmel River: (1) the Narrows and (2) the Lagoon. The

Narrows site is at river mile 9.6 and represents conditions in the Upper Carmel Valley (i.e., San Clemente Dam to the Narrows); the Lagoon is at river mile 0.0 and reflects streamflow conditions in the Lower Carmel Valley (i.e., Narrows to the Lagoon).

The streamflow analysis is based on monthly simulated values for the period 1902-1991. The values were generated by CVSIM for each long-term water supply alternative assume a Cal-Am buildout demand of 22,750 AF per year. For the No Project alternative, Cal-Am demand was assumed to be 17,359 AF per year. It should be noted that the "demand" assumed for Cal-Am represents normal-year production by the Cal-Am system. In the simulations, this demand was adjusted monthly for changes expected during wet, dry, and critically dry inflow conditions and included a seven percent adjustment for Cal-Am distribution system losses.

The simulated streamflow values were assessed under four conditions: normal, dry, critically dry and severe. "Normal" conditions are those that occur relatively frequently and are defined in this analysis by the median (50 percent exceedance frequency). "Dry" conditions are those that occur somewhat infrequently (25 percent of the time) and are represented by the 75.0 percent exceedance frequency. "Critically dry" conditions would occur relatively infrequently (12.5 percent of the time) and are represented by the 87.5 percent exceedance frequency. The severe drought years would occur only five percent of the time (95 percent exceedance frequency).

Appendix 7-A provides detailed tables and figures that compare the streamflow that would be expected with the five project alternatives under these four conditions. The summary of streamflow data provided in this chapter primarily focuses on the normal and critically dry years. It is assumed that the No Project alternative represents the existing situation. For this analysis, the monthly streamflow values are expressed by volume (AF) and mean daily flow (cfs). The mean daily flow is calculated by dividing the monthly volume by the number of days in the month and converting to cfs, assuming a constant 24-hour flow rate. It should be noted that the flow patterns simulated by CVSIM for each alternative reflect specific project operations (see Chapter 4, Project Description). Changes in these operations would result in different streamflow patterns.

Standards of Significance

It is difficult to set specific, absolute standards of significance for streamflow impacts. Conventionally, changes in streamflow are evaluated indirectly through assessments of the impacts to flow-dependent resources such as fisheries, riparian vegetation, and wildlife (see Chapter 8, Fish and Aquatic Life, and Chapter 9, Vegetation and Wildlife). Other than extreme cases of streamflow depletion or regulation, there are no generally recognized standards of significance for impacts on streamflow.

For purposes of this analysis, it is assumed that a significant impact to streamflow would occur when flow in the Carmel River mainstem becomes discontinuous. Presently, whenever streamflow at the Narrows is less than approximately five cfs, a one-mile reach below Carmel Valley Village (river mile 12.7 - 13.7) becomes dewatered. Therefore, for this analysis, a significant impact to streamflow in the upper Carmel Valley would occur whenever the simulated, mean daily flow is less than five cfs at the Narrows. Similarly, a significant impact to streamflow in the lower Carmel Valley would occur whenever the mean daily flow at the Lagoon is zero cfs. Information is also provided on whether or not flow at the Lagoon equals or exceeds 5 cfs.

7.2.2 GROUNDWATER STORAGE ANALYSIS

In this analysis, the impacts of each alternative on groundwater storage in the Carmel Valley aquifer and Seaside Coastal Groundwater Basin are assessed. Specific attention is given to prevention of seawater intrusion in the Carmel Valley and Seaside coastal areas. The analysis focuses on monthly estimates of usable storage in three areas: (1) upper Carmel Valley, (2) lower Carmel Valley, and (3) Seaside coastal areas. The upper Carmel Valley area consists of subunits 1 and 2 and the lower Carmel Valley area consists of subunits 3 and 4 of the Carmel Valley aquifer (see Figures 7-1 and 7-2). The Seaside coastal area includes the Northern and Southern Seaside Coastal Subbasins and a portion of the Fort Ord subbasin (see Figure 7-3). In Carmel Valley, usable storage refers to groundwater that is either above the perforations of Cal-Am's existing production wells or can be extracted by Cal-Am's existing production wells. In the Seaside coastal area, usable storage refers to the volume of groundwater in storage that results in water levels above mean sea level.

The groundwater storage analysis is based on end-of-month storage estimates simulated for the period 1902-1991. The values were generated by CVSIM for each long-term water supply alternative are based on a Cal-Am buildout demand of 22,750 AF per year. For the No Project alternative, Cal-Am

demand was assumed to be 17,359 AF per year. The simulated groundwater storage values are also assessed under the four conditions as defined in Section 7.2.1 above.

Appendix 7-B provides detailed tables and figures that compare the aquifer storage that would be expected with the five project alternatives under these four conditions. The summary of aquifer storage data provided in this chapter primarily focuses on the normal and critically dry years. Also, the analysis pertains to the lower Carmel Valley (aquifer subunits 3 and 4) as the upper subunits 1 and 2 would be fully saturated except in the most severe conditions. It is assumed that the No Project alternative represents the existing situation.

For this analysis, the monthly groundwater storage values are expressed in AF and as the percentage of maximum usable storage capacity. The percent of maximum was calculated by dividing the end-of-month usable storage value by the maximum usable storage value for each groundwater source. It should be noted that the groundwater storage values simulated by CVSIM for each alternative reflect specific project operations (see Chapter 4, Project Description). Changes in these operations would result in different groundwater storage values.

Standards of Significance

It is difficult to set specific, absolute standards of significance for groundwater storage impacts. Conventionally, changes in groundwater storage and lowered water levels are evaluated directly through assessments of the impacts to water quality (e.g. seawater intrusion) or indirectly through assessments of impacts to riparian vegetation (see Chapter 9, Vegetation and Wildlife). Other than extreme cases of aquifer compaction and subsidence, there are no generally recognized standards of significance for impacts on groundwater storage.

With respect to the potential for seawater intrusion, CVSIM is designed and operated to preclude this impact. In the simulations, no groundwater pumpage is allowed that would extract water from below mean sea level in the Seaside coastal area or extract water from the groundwater in reserve (unusable) in subunits 3 and 4 of the Carmel Valley aquifer.

For these reasons, no standards of significance are specified for impacts to groundwater storage in the Carmel Valley aquifer and Seaside Coastal Groundwater Basin.

7.2.3 FLOW FREQUENCY AND CHANNEL GEOMETRY ANALYSIS

The alternatives evaluated as part of this EIR/EIS vary considerably in the potential to affect hydrologic and hydraulic characteristics of the Carmel River. This analysis used annual maximum mean daily discharge, which is obtained from CVSIM. Often, instantaneous peak discharge is used in a frequency analysis. However, this would require the development of a sophisticated rainfall/runoff model, which is beyond the scope of this evaluation.

Usable capacity of the existing reservoirs is 1,968 AF at Los Padres and 131 AF at San Clemente. This is very small compared to a mean annual flow of 64,500 AF at Robles del Rio. The effect of these reservoirs on large storm flows is less than significant. Even the largest reservoir being evaluated fills quickly in wet years and has little impact on storms greater than the ten-year event.

Changes in flow frequency can change channel geometry. Hydrologic and geomorphological literature cites the concept of "dominant," "effective," or "channel-forming" discharge theory to explain channel formation. Briefly, this is the discharge that is the dominant influence in shaping the channel. While large flows often drastically change channel form, they happen too infrequently to predominate. Smaller flows, on the other hand, do not have the power to carry sediment and alter the shape of the channel significantly.

On many rivers, research has shown that channel geometry is controlled by flows with a recurrence of between one and three years. It has been found for the Carmel River, the effective flow varies from about the 2-year storm flow at Robles del Rio to the 2.4-year flow at the "near Carmel" site.[20] Modification of these frequent storm flows will likely result in long-term changes to the cross-sectional shape of the river channel and the amount of sediment that the river conveys. Channel conditions in the Carmel River are influenced not only by the flow of water, but also by local variations in bank erosion potential and the amount of vegetative cover.

Since 1987, the Carmel River Basin has been subject to a sustained drought, which has allowed vegetation to become established within the active riverbed (i.e., that part of the channel subjected to frequent flooding and change). Vegetative growth (primarily willows) is another significant factor that shapes the river channel. Analysis of aerial photographs shows that dense vegetation encroachment along base flow channels has occurred in as little as five years.[21]

The presence of willows in the riverbed creates a place for gravel bars to form, thus altering the channel characteristics of the river. Normally, flows with a magnitude of between the 1.5 and 2.4-year storm would scour the river bottom and wash young willows downstream. However, recent experience shows that established, young vegetation (2-5 years old) can withstand moderate stormflows up to the 3.5-year event and may, in some cases, resist general bed mobilization.

It is clear that the health and density of vegetation plays a large role in determining the discharge that forms the channel. The relative effectiveness of a particular flow may depend more on the ability of a flow to scour vegetation than on the ability to transport sediment over a particular period of time.

In an effort to better define the possible effects, studies were conducted on the impacts of other reservoirs and their receiving streams in the central coastal California region.[22] Research has indicated that the capacity of the Carmel River to pass storm flows of a 1.5 to 2.4-year magnitude could be reduced by about 40 percent. This would most likely require between 10 and 30 years.

Because of the factors cited, impacts of the various alternatives on channel geometry were not determined using a rigorous mathematical or quantitative method. However, the effects on sediment transport were studied in some detail and the results were used to indicate relative impacts on channel geometry for each of the project alternatives being evaluated.

Standards of Significance

Because the Carmel River is a complex and dynamic system, a numerical change in channel geometry is difficult to predict. For this reason, a specific numerical standard is not set. Potentially significant impacts to channel capacity in the Carmel River are assumed to occur for the mainstem reservoir alternatives (24 NLP, 24 NLP/D), based on observations of other streams in similar watersheds that have been dammed, and on current knowledge of the Carmel River.

7.2.4 SEDIMENT TRANSPORT AND CHANNEL STABILITY ANALYSIS

Reservoirs may affect the sediment transport characteristics of a watershed in several ways. First, as a consequence of the changes in the flow regime discussed in the previous section, the ability of the river to move sediment would be altered. Any substantial change in the flow or sediment transport

regime of the Carmel River could also affect the stability of the river channel as it flows through the alluvial reach below the existing San Clemente Dam. For example, projects that increase low flows during the summer and fall would enhance the growth and survival of bank-stabilizing riparian vegetation, and would have a beneficial effect on bank stability and reduced bank erosion. Second, reservoirs tend to act as effective sediment traps for the bulk of the sediment being produced from the upstream drainage basin.

The sediment transport characteristics of the Carmel River and its tributaries have been studied extensively.[23,24,25,26,27,28] These studies have attempted to define a sediment budget for the Carmel River to develop management practices to deal with the channel instability prevalent along portions of the river.

Several events have influenced the development of a sediment budget for the Carmel River. The drought of 1976-1977 contributed to massive die-off of vegetation in the riparian corridor. Subsequent large storm flows in 1978, 1982, 1983 and 1986 eroded banks and adjacent terrace deposits and introduced large amounts of sediment into the river system. Sediment transport measurements at the lower end of the Carmel Valley (at Via Mallorca) show an unusually large amount of sediment exiting from the Carmel Valley that may be the result of a large "slug" passing through the river.

On the other hand, sediment transport at Esquiline Road bridge may be low because the supply of sediment from the upper basin is cut off by existing dams. Transport equations are useful to detect trends in impacts predicted for the various alternatives.[29] However, these equations cannot be used to precisely predict the impacts of various alternatives on sediment transport.

Potential changes to the flow regime of the Carmel River by the various alternatives consist of changes in magnitude, frequency, duration, seasonal timing and location. Each of these changes could impact, to some degree, sediment transport and will be discussed in the impacts section for each alternative.

Sediment transport rates generally vary as a power function of the flow. Therefore, it follows that any reduction in storm flows will have an even more dramatic effect on sediment transport. This effect should be more notable in the larger mainstem reservoir alternatives. Flow frequency changes

discussed in the previous section also indicate a reduction in the frequency of years in which the river could transport channel forming amounts of sediment.

This issue becomes important when considering sediment delivered to the mainstem by unregulated tributaries. Tributaries continue to deliver sediment after a proposed reservoir is built. The frequency of flows capable of moving the sediment deposited at the confluence is reduced. The combination of high flow on a tributary combined with low flow on the mainstem (hydrologic desynchronization) can cause downcutting in tributaries.[30] This is probably not significant on the Carmel River as its tributaries are generally steep, and have relatively short confluences, which are confined to the narrow valley floor. Sediment discharge has been shown to cause deltas to form in mainstem areas, impacting fisheries habitat for spawning and rearing.

Tributary sediment comprises approximately 10% of the total sediment load of the Carmel River. While it appears that tributary sediment build-up on the Carmel River occurs under existing conditions, it could occur more often and with greater magnitude with the various project alternatives.

Any change in the duration of flows at different locations along the river would likely impact the movement of sediment. In general, the project alternatives would decrease the flows from November through April and increase flows in May through October. The greatest reduction in sediment transport would occur in November. As a reservoir fills, there is less attenuation of storm flows, and the effect of the reservoir on sediment transport downstream decreases.

At flows greater than 500 cfs the river tends to cut directly through the sand barrier at the mouth of the river, thereby flushing out sediment. At flows lower than 200 to 300 cfs the winter waves tend to push the river channel to the southern end of the beach where it crosses a bedrock lip. This bedrock outcrop allows flow to pass while trapping sediment in the lagoon.

Increased flows during May to October would only affect suspended load in reaches with a cobbled bed. Currently, much of the riverbed between Robles del Rio and Via Mallorca has little sand. Downstream of Via Mallorca, the increase in flow from May to October could increase the amount of sand delivered into the Lagoon. At the Lagoon, flow magnitude governs whether sediment is trapped or passed through to the ocean.

During periods of lower flows, each of the reservoir projects could deposit more sand in the Lagoon than the No Project alternative. However, much of the sand introduced into the river from 1978 through 1986 has already moved downstream of Via Mallorca. It is quite possible that once the riverbanks become stabilized and the excess sediment currently stored in the channel is flushed out, sediment accumulation during low flow periods may not be a significant amount.

Dams are generally very efficient sediment traps for sediment delivered from the watershed. Trap efficiency is a function of the reservoir storage and length, the incoming sediment load, the rate of releases, the topography of the pool (deep vs. shallow), and the type and location of the outlet gates. The existing dams on the Carmel River currently trap all of the bedload from the upper watershed and a portion of the suspended load. Matthews estimated the current trap efficiency of Los Padres Dam to be 72 percent; the trap efficiency for the smaller San Clemente Dam has been estimated to be 20 percent.[31] The proposed New Los Padres Reservoir would likely have a trap efficiency in excess of 95 percent. However, the impacts of reduced sediment in the river below the dam (downcutting of the channel and possible bank erosion) have already occurred on the Carmel River due to the existing dams. It is expected that the increase in trap efficiency will not have an appreciable effect downstream.

In the following sections, the impacts each alternative would have on sediment transport and overall channel geometry is evaluated in more detail and mitigation measures are suggested where necessary.

Standards of Significance

Due to the complexity of the Carmel River system, quantitative impacts of project alternatives on sediment transport and channel geometry are difficult to establish. One can predict that sediment will move and that vegetation will be introduced into the active riverbed, but it is difficult to predict where and how it might impact the river system. However, it was assumed that an alternative that could reduce stormflows capable of changing the channel form (i.e., those flows greater than the 1.5 year storm) would have a potentially significant impact on sediment transport.

7.3 IMPACTS AND MITIGATION MEASURES OF PROJECT ALTERNATIVES

For each alternative, the following sections will address the following impacts: (1) streamflow in the Carmel River, (2) groundwater storage in the Carmel Valley alluvial aquifer and Seaside Coastal Groundwater Subbasin, (3) channel capacity, and (4) sediment transport and channel stability.

7.3.1 24,000 AF NEW LOS PADRES RESERVOIR (24 NLP)

Impact 7.3.1-1

Overall, the 24 NLP alternative would have a beneficial impact on streamflow in the Carmel River.

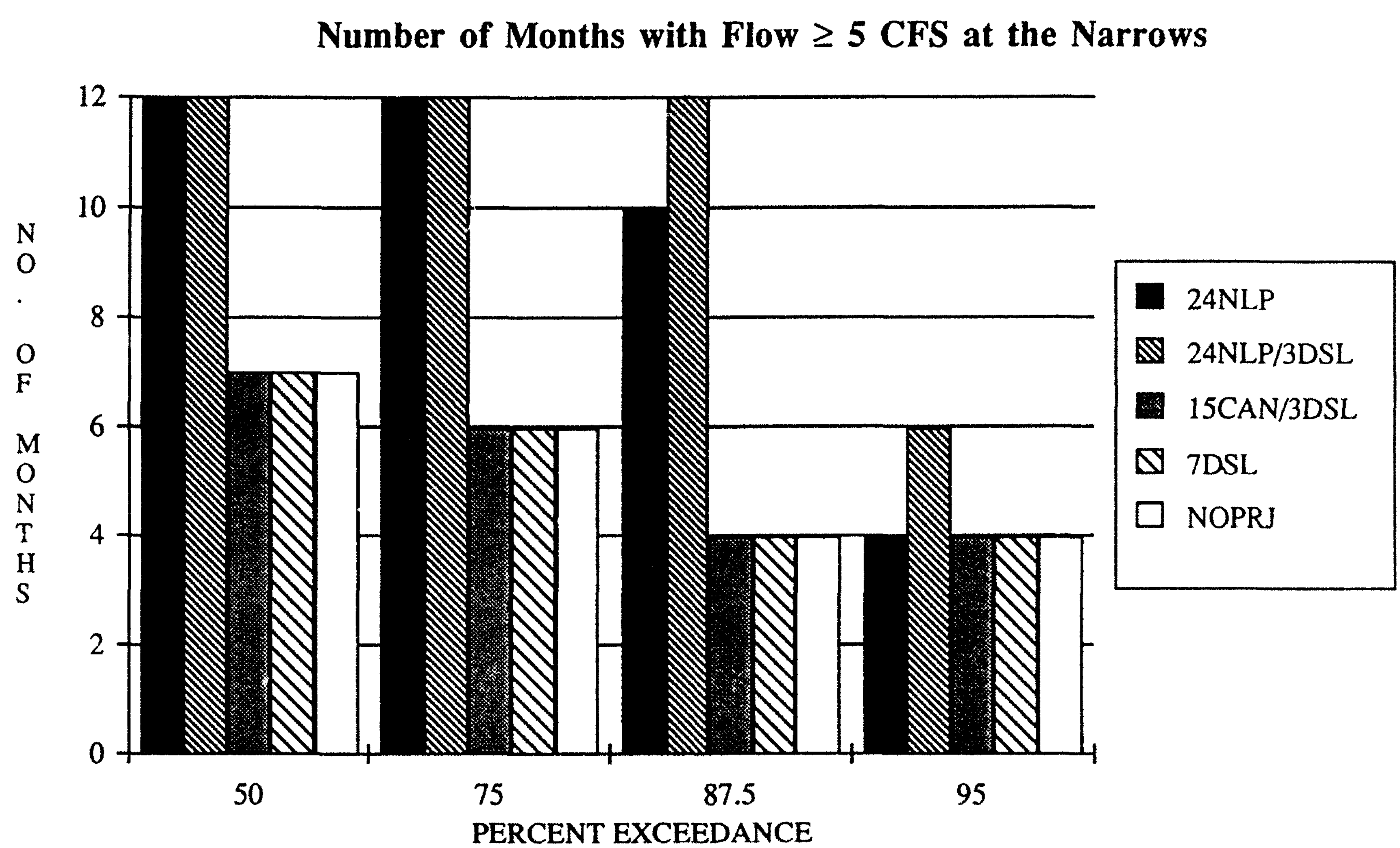
Year-round flow anticipated with the 24,000 AF New Los Padres Reservoir (24 NLP) would significantly improve the existing (No Project) situation in summer and fall of normal years, and nearly the entire year in dry years. Existing conditions result in a dry riverbed in summer and fall in the lower Carmel Valley (even in normal years) and extensive dewatering during dry periods. The 24 NLP alternative would entail some periods of inadequate flow in critically dry years, but would still provide improved conditions compared to the No Project situation; the streamflow regime would be similar to the No Project alternative in a severe drought year. The overall effect would be beneficial. Please refer to Appendix 7-A for detailed information.

Flow at the Narrows. Under simulated conditions, flow at the Narrows would always exceed 5 cfs in normal and dry years with the 24 NLP alternative (Figure 7-4). In normal years, the project would provide flows in the 20-25 cfs range from June through December, and 60-165 cfs in January through March. Flow at the Narrows with the 24 NLP alternative would be several times greater than the No Project alternative from June through November, and up to 30 percent less in winter and early spring.

In critically dry years, flows with the 24 NLP would be greater than five cfs in 10 out of 12 months; this would be reduced to four months in a severe drought, similar to the No Project alternative (Figure 7-4). Flow would be in the 4-6 cfs range in October through December, and would range from about 10 to 45 cfs the rest of the year. The 24 NLP flows would be about 3-5 times greater than the No Project from April through September, and similar to the No Project flows the rest of the year.

NUMBER OF MONTHS WITH FLOW 5 CFS OR GREATER AT THE NARROWS

FIGURE 7-4



SOURCE: MPWMD

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Flow at the Lagoon. In normal years, there would always be streamflow at the Carmel River Lagoon with the 24 NLP alternative (Figure 7-5); flow would be 5 cfs or greater (Figure 7-6). Flow would cease in one out of 12 months in dry years (Figure 7-5). Normal year flows with the 24 NLP alternative would be 5-6 cfs from June through December, which would be an important improvement over the mostly zero No Project flows during the same period. The 24 NLP alternative would result in flows of 40-150 cfs in January through May.

In critically dry years, flow to the Lagoon would cease to occur in seven out of 12 months compared to nine months with the No Project alternative (Figure 7-5). Flows into the lagoon with the 24 NLP alternative would range from 2-20 cfs in January through May. There would be no flow to the lagoon in a severe drought.

It should be noted that any reductions or increases in streamflow due to operation of the 24 NLP alternative are governed by the bypass logic and rule proposed by CDFG and modified by MPWMD (see Chapter 4, Section 4.1.3). This rule is designed to reflect and mimic natural flow conditions as much as possible.

Mitigation Measure 7.3.1-1

None necessary; the overall impact would be beneficial.

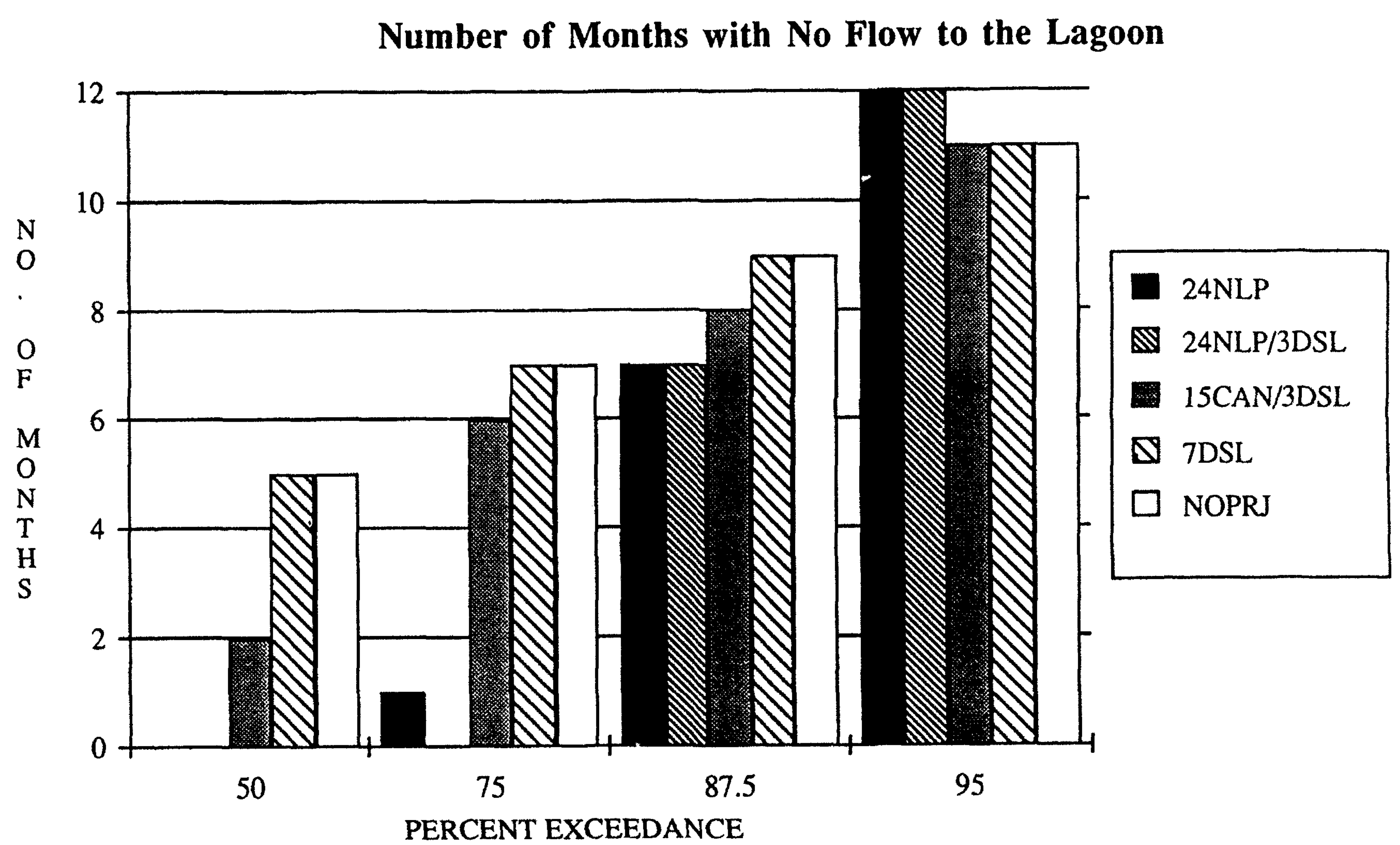
Impact 7.3.1-2

The 24 NLP alternative would result in substantially more aquifer storage in lower Carmel Valley than the existing situation in most years. Overall, this would be considered a beneficial impact.

Under simulated conditions, normal year aquifer storage in lower Carmel Valley at buildout with the 24 NLP alternative would result in a fully saturated aquifer from January through May, and would never fall below 94 percent of maximum. The average annual storage would be 98 percent of maximum, as shown in Figure 7-7. In critically dry years, usable storage with the 24 NLP alternative would range from 71 to 98 percent of maximum, and would average 85 percent, as shown in Figure 7-8. In both cases, the 24 NLP alternative would provide substantially more storage than the existing

NUMBER OF MONTHS WITH NO FLOW TO THE LAGOON

FIGURE 7-5



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SOURCE: MPWMD

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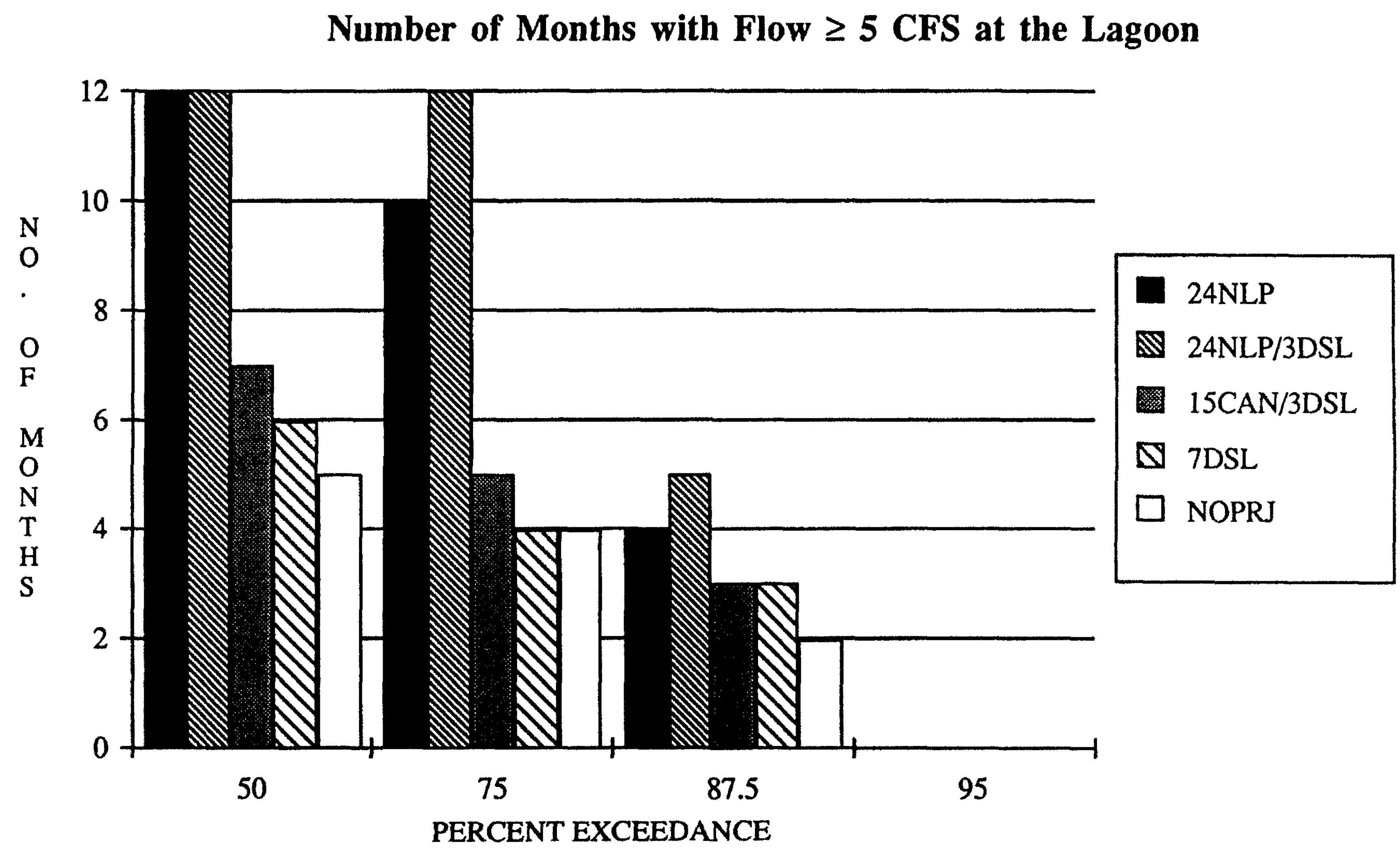
NUMBER OF MONTHS WITH FLOW 5 CFS OR GREATER AT THE LAGOON

FIGURE 7-6



SOURCE: MPWMD

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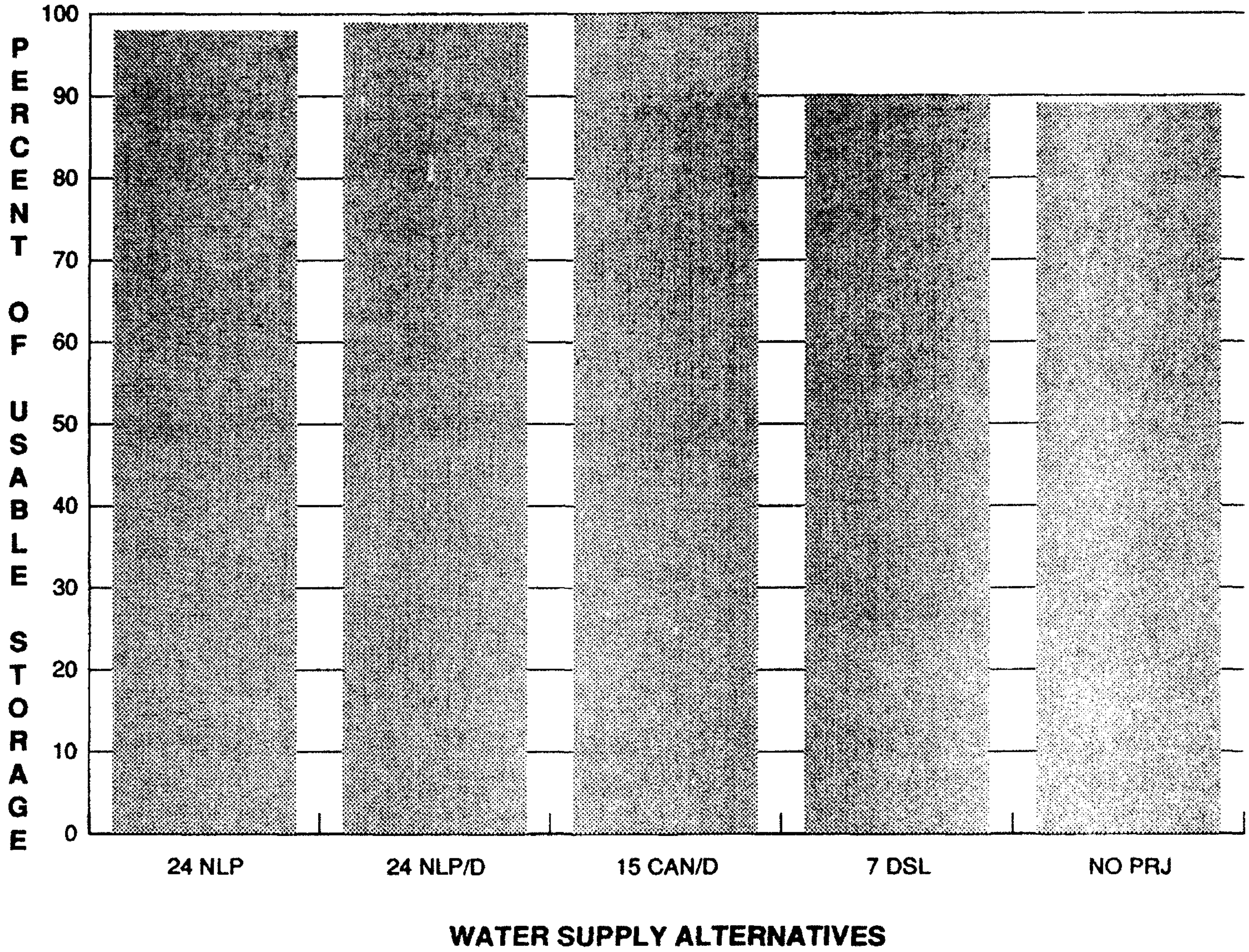
LOWER CARMEL VALLEY AQUIFER, AVERAGE ANNUAL PERCENT OF MAXIMUM STORAGE, NORMAL YEAR, 50% EXCEEDANCE FREQUENCY

FIGURE 7-7



SOURCE: MPWMD

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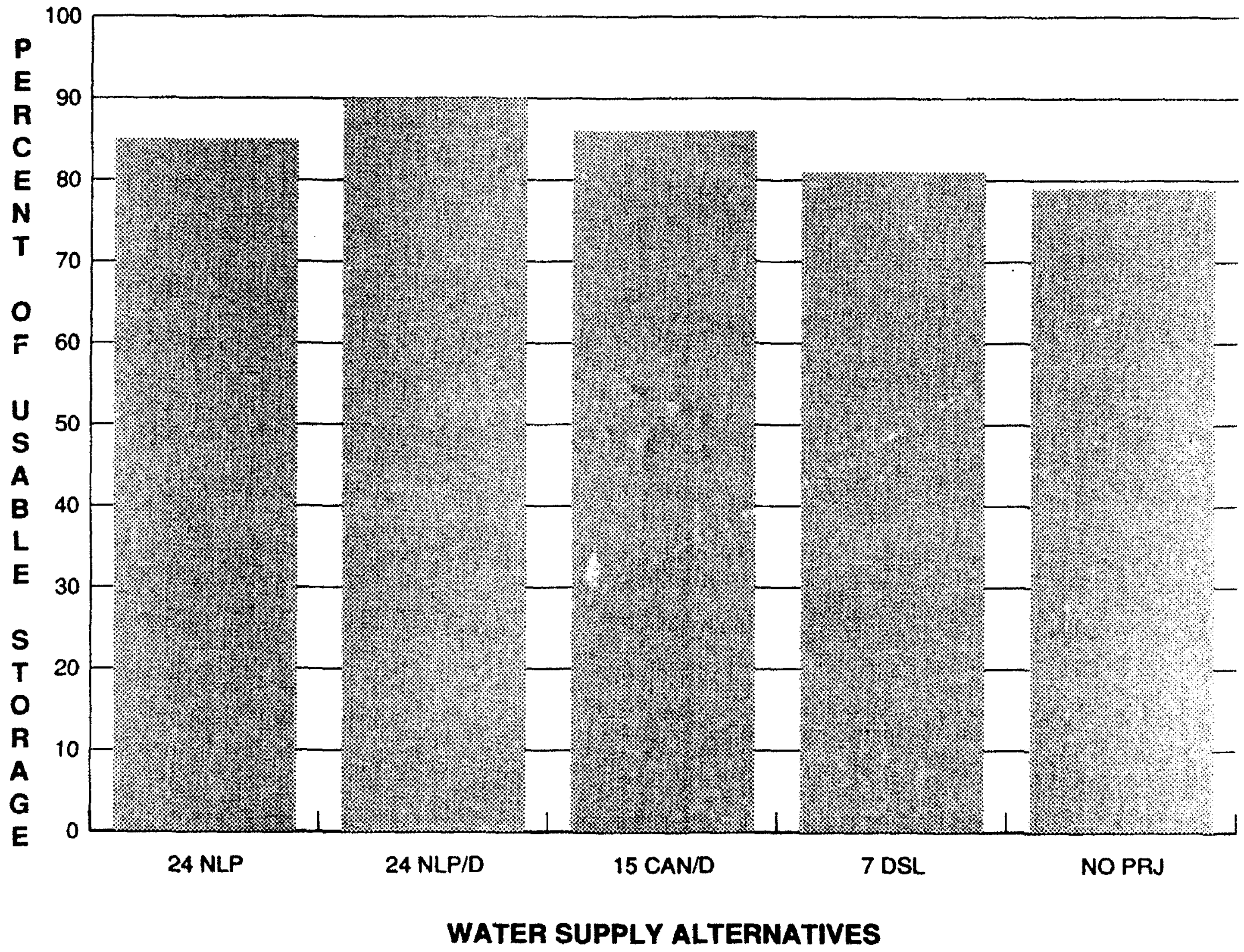
LOWER CARMEL VALLEY AQUIFER, AVERAGE ANNUAL PERCENT OF MAXIMUM STORAGE, CRITICALLY DRY YEAR, 87.5% EXCEEDANCE FREQUENCY

FIGURE 7-8



SOURCE: MPWMD

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situation (No Project) especially in summer and fall. In severe drought years, average aquifer storage with the 24 NLP alternative would be about 25 percent less than with the No Project alternative (see Appendix 7-B).

Mitigation Measure 7.3.1-2

None necessary; this impact would be considered beneficial.

In severe drought years, average aquifer storage would be as low as 34 percent of maximum. This would not harm the aquifer as additional "unusable" storage remains below the perforations of well casings, and the project operations are designed to preclude seawater intrusion. However, low ground water levels in rare severe events could possibly impair water supply from shallow private wells near large Cal-Am municipal wells.

Impact 7.3.1-3

The 24 NLP alternative would have a beneficial impact on groundwater levels in the Seaside Basin as it would result in somewhat greater aquifer storage than the No Project alternative in all water year types evaluated.

Under normal conditions, usable groundwater storage in the Seaside Coastal Subbasin would be depleted to some degree for all alternatives. Because of the uniform recharge rate that is assumed in the CVSIM model, groundwater storage in Seaside is fully recharged only during wet periods (i.e., 12.5 percent exceedance frequency) when Cal-Am production is reduced.

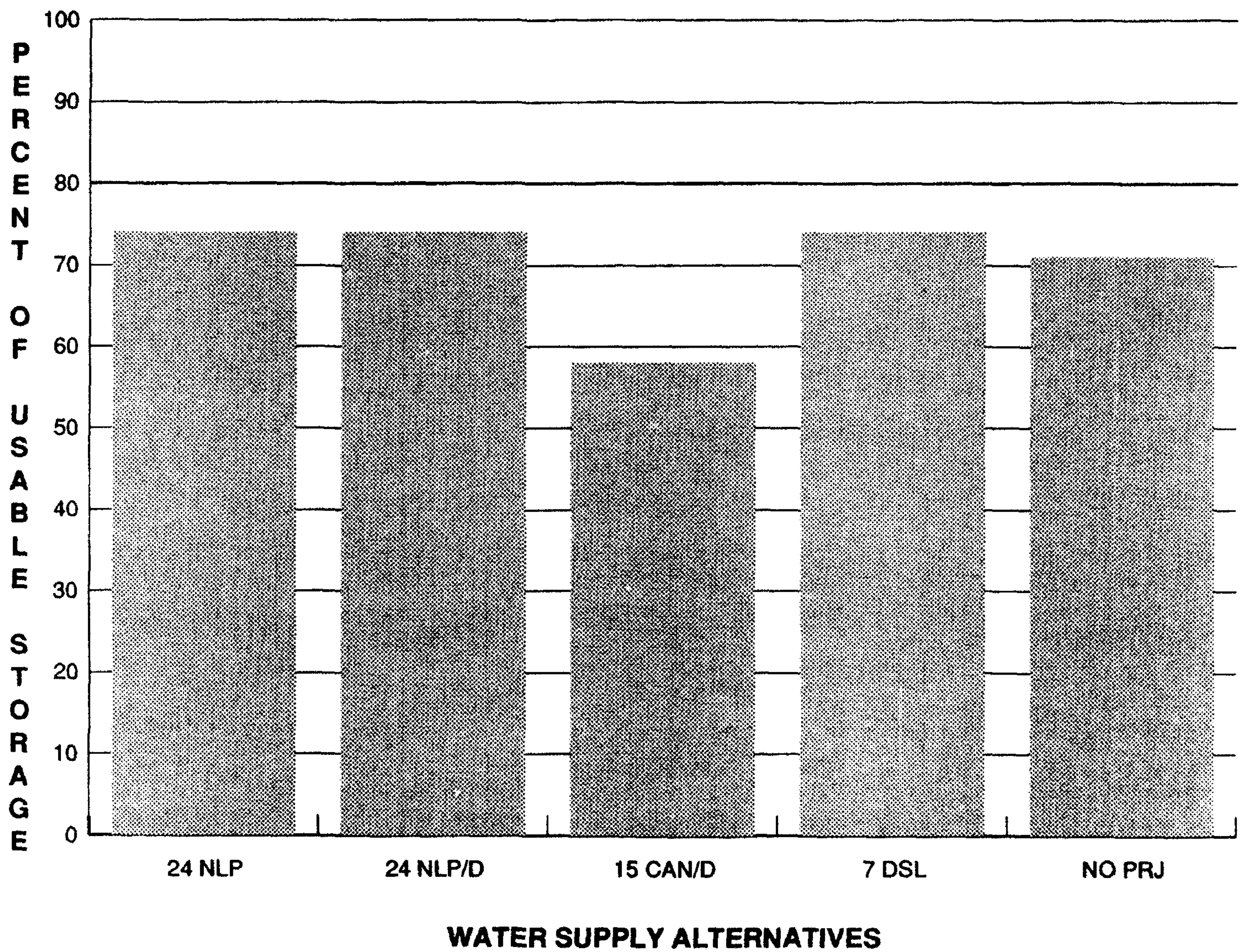
In normal years, usable groundwater storage with the 24 NLP would vary from 70 to 77 percent of maximum, and would average 74 percent of maximum (see Figure 7-9). Under critically dry conditions, usable groundwater storage in the Seaside Coastal Subbasin would be somewhat depleted for all alternatives. Usable groundwater storage simulated for the 24 NLP alternative would range between 35 and 46 percent of usable capacity and average 40 percent of capacity (Figure 7-10). Storage would be greater than with the No Project alternative in all water year types (Appendix 7-C).

Mitigation Measure 7.3.1-3

None needed as the impact is beneficial.

COASTAL SEASIDE AQUIFER, AVERAGE ANNUAL PERCENT OF MAXIMUM STORAGE, NORMAL YEAR, 50% EXCEEDANCE FREQUENCY

FIGURE 7-9



SOURCE: MPWMD

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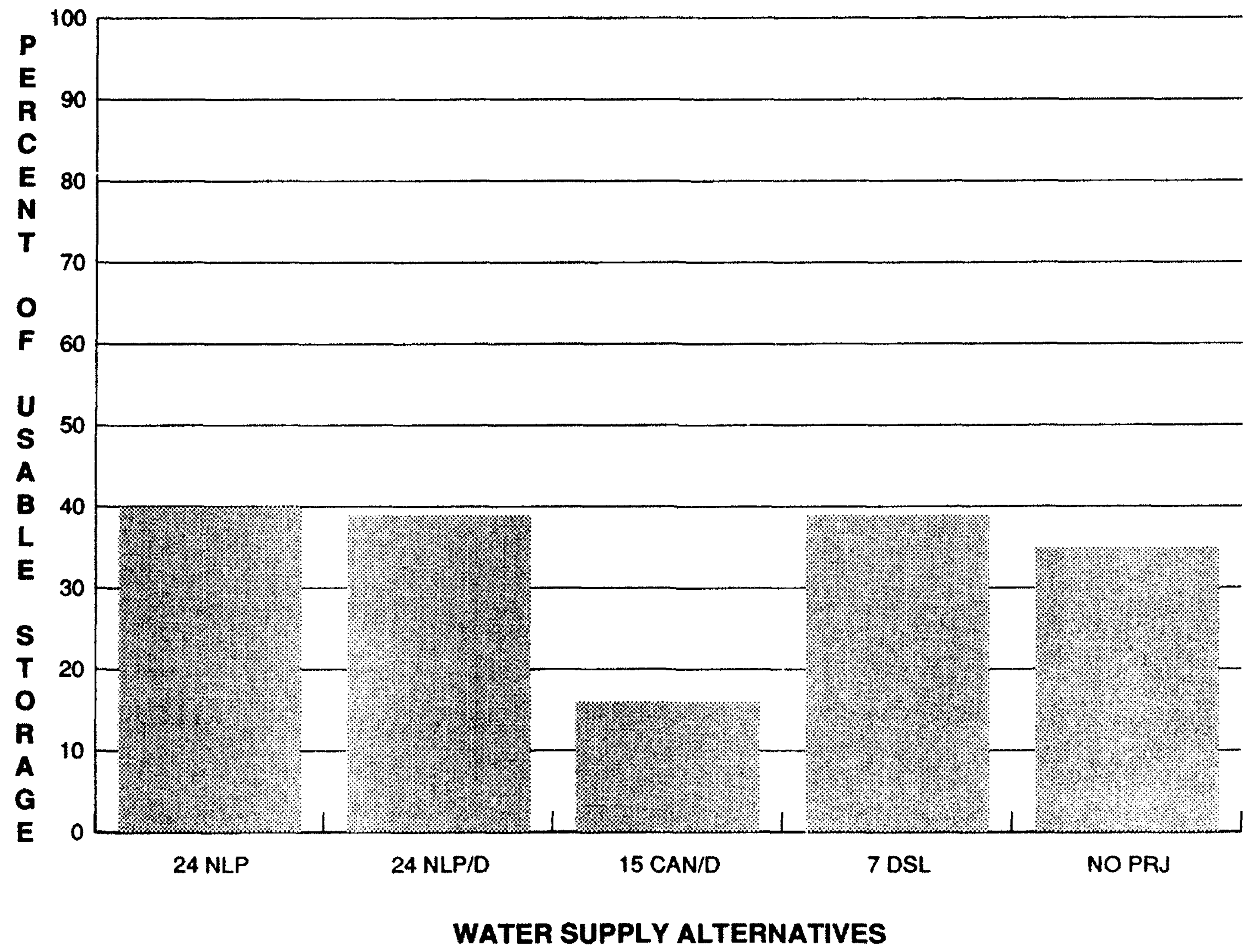
COASTAL SEASIDE AQUIFER, AVERAGE ANNUAL PERCENT OF MAXIMUM STORAGE, CRITICALLY DRY YEAR, 87.5% EXCEEDANCE FREQUENCY

FIGURE 7-10



SOURCE: MPWMD

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It should be noted that CVSIM simulations for water years 1990-91 at buildout indicate there would be zero usable storage during this period with the 24 NLP alternative. No simulated seawater intrusion would occur because the CVSIM code curtails well pumping if water levels reach sea level. In actual practice, water levels and chloride concentrations would be monitored. If the monitoring indicated that there was a threat of seawater intrusion, then pumping would be curtailed and the subbasin would be allowed to recharge to provide a further safeguard.

Historically, groundwater levels in the Seaside Coastal Subbasin have been pumped below sea level without any evidence of seawater intrusion or other adverse impact to the aquifer system. This drawdown was, however, limited to localized areas surrounding Cal-Am's production wells and was not as extensive as is simulated. The level of production that is allowed in the simulations is constrained by the definition of usable storage and the long-term yield specified for the Cal-Am system in Seaside and is designed to prevent seawater intrusion. Nonetheless, because of the simplifying assumptions and rigid rules used in the CVSIM simulations, it is not certain whether or not seawater intrusion would occur under sustained critically dry conditions.

Under actual conditions, however, it is unlikely that seawater intrusion would occur in the Seaside Coastal Subbasin. Currently, water levels and water quality parameters are monitored to detect any early indications of intrusion. If water levels decline, the monitoring would be intensified and pumping would be curtailed, if necessary. In addition, it should be noted that a portion of the off-shore groundwater storage acts as a buffer against seawater intrusion. The degree of effectiveness of this buffer is, however, uncertain.

Impact 7.3.1-4

Operation of the 24,000 AF New Los Padres Reservoir could reduce downstream channel capacity and increase flood elevations.

Encroachment of vegetation into the channel is one possible result of reducing the frequency of flows with a recurrence interval of 5 years or less. This alternative has a significant impact on these flows (Table 7-8). Channel narrowing is possible, but the impact is less than for the medium-sized dams, which attenuate more of the flows capable of scouring the channel. The public health and safety implications are discussed in Chapter 15.

TABLE 7-8

FLOW FREQUENCY ANALYSIS
SIMULATED ANNUAL MAXIMUM MEAN DAILY FLOW

	Annual Maximum Flow (cfs)[1] with a Recurrence Interval of					
ALTERNATIVE	1.5-YR	2.0-YR	2.4-YR	3-YR	5-YR	10-YR
Carmel River at Robles Del Rio						
24 NLP	220	390	900	1,900	3,050	4,300
No Project	640	1,300	1,950	2,400	3,600	4,400
% Reduction	66%	70%	54%	21%	15%	2%
Carmel River Near Carmel						
24 NLP	220	430	870	1,850	3,250	4,400
No Project	600	1,320	1,850	2,500	3,700	4,550
% Reduction	63%	67%	53%	26%	12%	2%

[1] Values calculated from CVSIM output for the 1958-1991 period based on the Weibull equation and a graphically interpreted line.

Source: Graham Matthews and Associates.

Channel capacity could be reduced through a combination of vegetation encroachment and a reduction in sediment transport. The impact of this alternative on flood elevations could vary and depends on the channel geometry prior to installation of a mainstem dam. The most significant changes to channel capacity could occur in wide reaches where vegetation encroachment could increase resistance to flow.

It should be noted here that there are many variables to be accounted for in the prediction of changes in downstream channel characteristics, and the estimation of each of these variables is subject to a degree of uncertainty. In addition, a wide variety of interactions is possible among independent and dependent variables in river systems, which means that river channels can adjust to changes in flow and sediment load in different ways. The existing river system has already been altered by the construction of San Clemente and Los Padres dams, but further channel changes are likely to ensue from further regulation of flows on the Carmel River. Therefore, given the uncertainties in predicting future changes in downstream channel capacities, this impact must be considered to be potentially significant.

Mitigation Measure 7.3.1-4

The MPWMD would establish pre-project baseline conditions, using aerial photography and surveys of channel cross sections. Prior to project approval, MPWMD would develop a formal program to monitor changes in channel capacity downstream of the project for an extended period of years. If reduction in capacity is confirmed, MPWMD, in consultation with other responsible resource agencies, would initiate procedures to restore channel capacity. Two methods of restoring channel capacity are anticipated. Initially, the channel would be cleared of vegetation to a width of approximately 40 to 60 feet, depending on the location. If this alone was not effective, it would be necessary to move sediment to clear the channel. This would be accomplished by physical removal (e.g., dredging or bulldozing). With these mitigation measures, the impacts are expected to be reduced to a less than significant level.

The MPWMD currently obtains an annual set of aerial photographs of the Carmel River channel from Carmel Bay to the upstream end of San Clemente Reservoir. These photographs have been used to monitor vegetation and channel changes annually since 1982. In addition, MPWMD staff has established a series of more than 30 cross section sites that are periodically re-surveyed to observe changes in channel geometry. These resources could form the basis of a formal program for monitoring impacts of dam construction on channel capacity and flood elevations.

A Monitoring Plan and Program would be developed in consultation with responsible resource agencies, and would entail specific procedures for monitoring as well as mitigation activities. Specific mitigation measures would depend on the nature and extent of changes in channel geometry and capacity that are observed. The District would set aside a contingency fund for mitigation measures as an integral element of the project financing package, and would include a line item for monitoring channel changes in the annual O&M budget for the project.

It should be noted that the MPWMD has carried out successful periodic vegetation removal and channel maintenance along the lower 15 miles of the Carmel River since 1984. These activities are performed under the auspices of the Carmel River Management Program and other District programs, and have not adversely affected the Carmel River environment. All projects have received the required permits from responsible resource agencies.

Impact 7.3.1-5

Operation of the 24,000 AF New Los Padres Reservoir could reduce scouring and increase base flows, which would promote channel stability.

By decreasing peak flood flows, the 24 NLP alternative would likely reduce bedload and suspended load in the reach downstream of Robles del Rio. This alternative could encourage growth of riparian vegetation because of the reduction of scouring and increased baseflow. Encroaching vegetation along the banks would promote channel stability and reduce erosion, and vegetation could encroach to the edge of perennial water levels. Thus, the destabilizing effects of willows in the low flow channel could be avoided by this alternative. Given the uncertainties in predicting future changes in sediment transport characteristics, this impact is considered to be potentially beneficial.

Mitigation Measure 7.3.1-5

No mitigation required. However, the MPWMD would monitor channel capacity downstream of the project for an extended number of years and clear encroaching vegetation if channel capacity would be adversely affected.

Impact 7.3.1-6

Reduction in the ability of the river to move sediment could allow sediment delivered from major tributaries to the mainstem to impact fisheries habitat.

There are six major tributaries downstream of San Clemente Dam and all discharge some sediment into the mainstem. This alternative increases the likelihood that tributary sediments would impact fisheries habitat. Since the magnitude of the impact is dependent on inflow patterns, and is therefore unknown, this would be considered a potentially significant impact.

Mitigation Measure 7.3.1-6

The MPWMD would monitor the amount and timing of sediment delivery for the six major tributaries and the impact on fisheries habitat. If inspection shows significant fisheries habitat degradation due to sediment deposition, the MPWMD would implement a tributary sediment management program, which could use such devices as sediment detention ponds for trapping bedload. These actions would reduce impacts to a less than significant level.

Impact 7.3.1-7

Changes in the magnitude of peak streamflows could result in a longer residence time for sediment currently stored in channel gravel bars, which could lead to bank erosion.

By reducing the frequency of occurrence of large, sediment moving flows, sediment currently stored in gravel bars would flush through the system more slowly. This increased residence time could allow vegetation to become established, redirecting subsequent storm flows into unprotected riverbanks and causing further erosion and sedimentation. While it is difficult to quantify this impact, it is clear that the greater the impact on flow frequency, the more likely it would be for this scenario to occur. Thus, this would be considered a potentially significant impact.

Mitigation Measure 7.3.1-7

A possible means of mitigating this impact is to remove vegetation as it becomes established on gravel bars and continue funding the Carmel River Management Program (or its successor) willow planting and river restoration projects, which remove gravel bars that are likely to cause damage and create a more stable channel. These actions would reduce impacts to a less than significant level.

Impact 7.3.1-8

An increase in summer/fall flows into the lagoon during dry periods could increase sand transport into the lagoon, potentially reducing habitat values.

There may be dry periods during which flows would neither breach the sand bar nor flush sediment out. Sand deposited into the lagoon would reduce its volume. Given the planned efforts of local agencies to implement a lagoon restoration plan, which includes dredging of the lagoon, the level of impact of additional sediment is unknown. Thus, this is considered to be a potentially significant impact.

Mitigation Measure 7.3.1-8

The MPWMD should monitor the actual sediment transport into the lagoon on an annual basis. If increased sediment transport is observed, the sediment would need to be removed from the channel prior to reaching the lagoon, by dredging or bulldozing. The volume of the lagoon, as well as the sediment inflow into the lagoon, should be monitored annually. If impacts occur, sediment can be removed prior to entering the lagoon, or a more efficient channel created through the beach to allow sediment to flush at flows of over 100 cfs. Alternatively, the lagoon enhancement efforts could include additional dredging to reduce impacts of sediment deposition. These actions would reduce impacts to a less than significant level.

Impact 7.3.1-9

The reduction in mean annual sediment yields that could be caused by this alternative could impact the amount of sediment available for beach replenishment.

Theoretically, the reduction in sediment yields could impact the amount of sand that is normally available to replenish the Carmel River State Beach. However, as noted earlier, the sediment yields since 1978 have been dramatically increased by major bank erosion along the lower river between river miles 4 and 9. Prior to this instability, yields were much lower and the beach was maintained. A review of historical aerial photography showed no apparent changes in the size or shape of the beach despite major changes in sediment delivery.[32] For these reasons, it is believed that less than significant impacts to the beach would occur.

Mitigation Measure 7.3.1-9

None necessary; less than significant impacts would occur.

7.3.2 24,000 AF NEW LOS PADRES RESERVOIR WITH 3 MGD DESALINATION PLANT (24 NLP/D)

Impact 7.3.2-1

Overall, the 24 NLP/D alternative would have a beneficial impact on streamflow in the Carmel River.

Addition of a 3 MGD desalination plant to the New Los Padres Reservoir (24 NLP/D) would result in a similar streamflow regime as described for the 24 NLP alternative alone under Impact 7.3.1-1. However, there would be some notable improvements due to the desalination facility, particularly in dry and critically dry years. As shown in Figure 7-4, the 24 NLP/D alternative would entail 12 months of flow greater than 5 cfs at the Narrows in critically dry years (instead of 10 months with 24 NLP), and two more months of 5 cfs flow in a severe year (six month compared to four months for all other alternatives). Flow to the Lagoon would be maximized in dry and critically dry years with the 24 NLP/D alternative (Figures 7-5 and 7-6), not only in terms of months of flow, but the amount of flow as well. Please refer to Appendix 7-A for detailed information.

Mitigation Measures 7.3.2-1

None necessary; the overall impact would be beneficial.

Impact 7.3.2-2

The 24 NLP/D alternative would result in substantially more aquifer storage in lower Carmel Valley than the existing situation in all water year types. This would be considered as a beneficial impact.

Under simulated conditions at buildout, normal year aquifer storage in lower Carmel Valley with the 24 NLP/D alternative would result in a fully saturated aquifer from December through May, and would never fall below 96 percent of maximum. The average annual storage would be 99 percent of maximum (Figure 7-7). In critically dry years, usable storage with 24 NLP/D would range from 80 percent to 3 months with 100 percent of maximum, and would average 90 percent (Figure 7-8). In both cases, the 24 NLP/D would provide substantially more storage than the No Project situation, especially in summer and fall. The addition of the 3 MGD desalination facilities to the 24 NLP reservoir greatly improves aquifer storage in critically dry and severe water years (see Appendix 7-B for detailed information).

Mitigation Measures 7.3.2-2

None necessary.

Impact 7.3.2-3

The 24 NLP/D alternative would have a beneficial impact on groundwater levels in the Seaside Basin as it would result in somewhat greater aquifer storage than the No Project alternative in all water year types evaluated.

Impacts would be similar to those described for the 24 NLP alternative (see Impact 7.3.1-3). Usable storage values for the Seaside Coastal subbasin in normal years with the 24 NLP/D alternative would result in values ranging from 70 percent to 77 percent of maximum, and would average 74 percent capacity (Figure 7-9). In critically dry years, average usable storage would be 39 percent of maximum (Figure 7-10).

Mitigation Measures 7.3.2-3

None needed as the effect would be beneficial. See discussion of Mitigation Measure 7.3.1-3.

Impact 7.3.2-4

Operation of the 24 NLP/D alternative would affect channel capacity and stability, and sediment transport in the Carmel River.

Hydrologic effects of the 24 NLP/D alternative would be essentially the same as those described for the 24 NLP alternative under Impacts 7.3.1-4 through 7.3.1-9.

Mitigation Measure 7.3.2-4

Mitigation measures would be the same as those described for the 24 NLP alternative to reduce impacts to a less than significant level.

Impact 7.3.2-5

Operation of the Ranney collectors associated with the 3 MGD desalination plant would alter ground water hydrology.

Ground water flow modeling was performed to assess the feasibility of extraction from the dune/beach sand aquifer. The purpose of the modeling effort was to simulate drawdown effects of extraction with the intent of identifying impacts that would constrain design. The initial flow model was constructed prior to field exploration and was modified as field data regarding aquifer geometry and hydraulic parameters were developed. All modeling efforts included the basic assumption that the shallow offshore stratigraphy was similar to that onshore, that the sand identified onshore continued offshore and daylighted on the sea floor. Use of the flow model confirmed that it would be feasible to extract the required volume of seawater through the construction of three collectors.

Analyses of the hydrogeologic data developed reveals that the Sand City area is not as favorable for the development of a seawater source as the previously investigated Marina site. Preliminary analysis prepared by Ranney indicates that collectors at the proposed sites would not be capable of the discharge rates of those proposed for Marina. Maximum discharge from collectors in Sand City would be limited to approximately 3.8 mgd. This value compares to the 5.9 mgd estimated for collectors at the Marina site. The reduced discharge rate is due to the substantially thinner section of sand in Sand City when compared to Marina (35 feet in Sand City verses 57 feet in Marina). Because of the reduced thickness of sand, the Sand City collectors would need to be sited closer to the ocean and would require more and longer laterals to achieve the 3.8 mgd.

Modeling by Ranney predicts a localized depression of the water surface of the saline-brackish aquifer in the immediate area of the collectors of approximately 20 feet, decreasing to approximately -1 foot at a distance of 1,800 feet. The drawdown effects are not considered significant, as static water surface elevations are approximately 2 feet above mean sea level (msl) in the study area, while the ground surfaces in the area range from 15 to 35 feet above msl. Given both the depth to water and the quality of the ground water, it is considered unlikely that the existing water table supports any phreatophytes; therefore, local depression of the water table would not likely impact plant communities within the dunes.

The localized depression of the water surface at the coast would, as intended, induce the landward flow of seawater. This landward flow is not considered significant, as the landward flow would be captured by the collectors. During periods when the collectors are idle, the normal seaward flow of ground water would resume.

The impacts associated with maintenance are considered minimal. Maintenance to the collectors is limited to periodic repair or replacement of the submersible pumps. Based on past experience, Ranney estimates a repair frequency of 10 years or more. If the collectors are to be buried, service or replacement would require the removal of any sand covering the collector and servicing of the pumps with a small crane or pump servicing truck. Either of these could be track-mounted, if necessary. Overall, the impacts of the Ranney collectors is considered less than significant.

Mitigation Measure 7.3.2-5

None required or recommended.

Impact 7.3.2-6

Injection of brine from the desalination plant via Ranney injectors into the shallow dune sand aquifer could affect marine water quality.

The proposed project would inject 4.5 mgd of reject brine (TDS = 57,400 mg/l) into the shallow dune/beach sand aquifer. This discharge would be subject to the requirements of the National Pollutant Discharge Elimination System (NPDES) permitting process, which is administered by the Regional Water Quality Control Board (RWQCB).

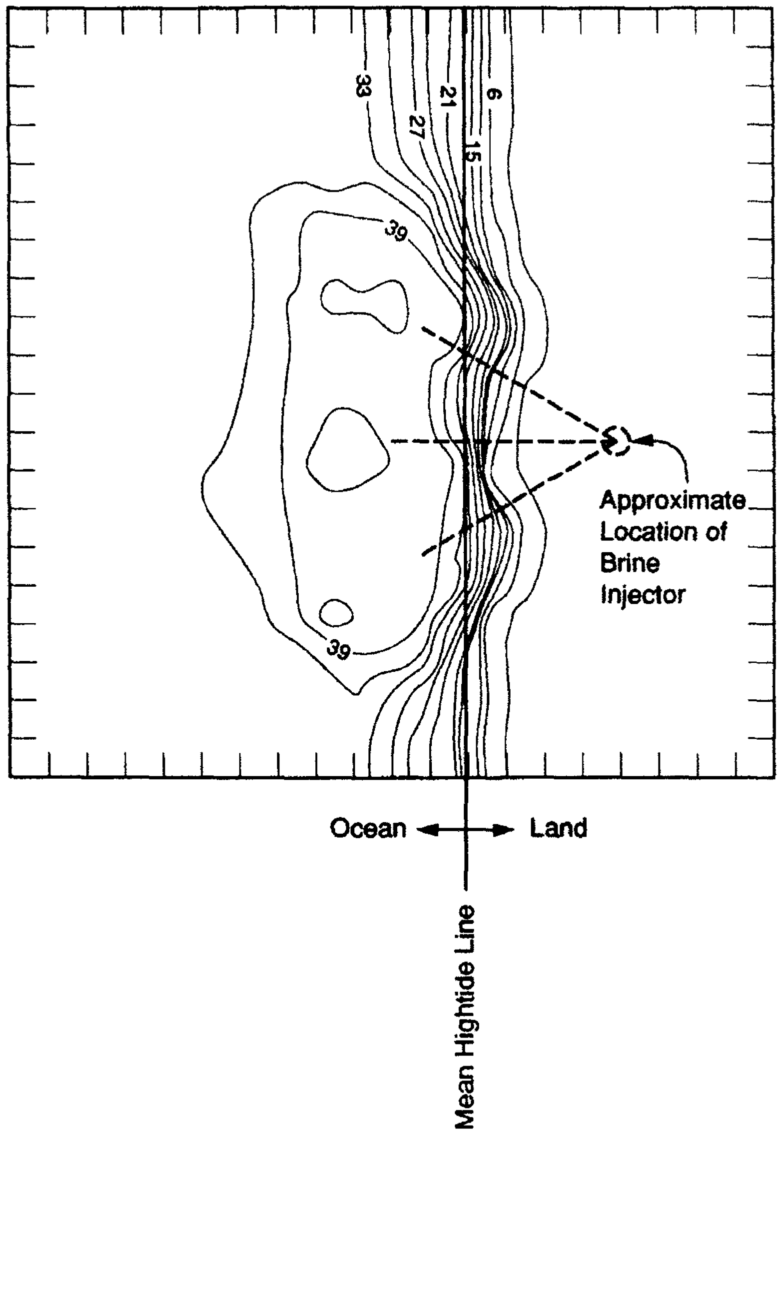
Ground water flow modeling was also performed to assess the feasibility of injection into the dune/beach sand aquifer. As with the groundwater extraction flow modeling, the purpose of this effort was to simulate mounding effects of injection with the intent of identifying impacts that would constrain design. The same procedures were used in this flow modeling as with the ground water modeling described above. The flow model revealed that, as a result of the relatively thin section of sand in hydraulic communication with the ocean, injection of the proposed volume of brine into the aquifer system at the proposed locations would raise ground water levels in the areas surrounding the injectors to elevations that would approach, or possibly exceed, the existing ground surface. The model was subsequently reconfigured to simulate the injection of brine from injector laterals that extended out under the sea floor. The simulations utilizing the revised injector configuration revealed the injection of the brine to be feasible.

Solute transport modeling was performed to assess the distribution and dilution of the brine that could be expected as a result of injection. Modeling was performed utilizing commercially available

modeling software designed to interface with the flow model. Transport parameters of dispersivity and diffusion were taken from the tracer test and literature values, respectively. The initial simulation utilized a coefficient of longitudinal dispersivity of 10 feet, based on the general relationship evident in the tracer test data and an assumed flow path length. The solute transport simulations modeled a single brine injector operating at a rate of 2.25 mgd. Simulations were performed assuming a brine with a TDS concentration of 54,700 mg/l. Brine was injected into the lower layer of the model and spatially distributed in accordance with the preliminary design of the injector discussed below. Initial conditions assumed the salinity of the pore-fluid within the sand underlying the ocean was in equilibrium with seawater and having a similar salinity (35,000 mg/l TDS). This assumption is considered conservative because a zone of mixing of fresh and seawater exists in the nearshore and, under some conditions, water underlying the sea floor is likely less saline than seawater. Model simulation times were extended until predicted concentrations within the aquifer system stabilized, indicating the achievement of steady state conditions. After completion of the first simulation, additional simulations were performed, utilizing more conservative values (lower) for the coefficient of longitudinal dispersivity to allow the assessment of sensitivity of the results to this value.

The results of the solute transport modeling are shown as pore-fluid concentration contours on Figures 7-11, 7-12 and 7-13. These figures present the predicted pore-fluid salinity concentrations at a depth of 2.5 feet below the sea floor. Figure 7-11 presents the results of a simulation utilizing a coefficient of longitudinal dispersivity of 10 feet. This simulation reveals that the operation of the brine injector, under the assumed conditions, would result in a maximum steady-state pore-fluid concentration of approximately 42,000 mg/l and would raise pore-fluid concentrations above that of seawater over an area of approximately 102,000 feet, or an area of approximately 2.5 acres. The predicted maximum concentration represents a dilution of approximately 23 percent of the injected brine. Figure 7-12 presents the predicted concentrations resulting from a second simulation utilizing a coefficient of dispersivity of five feet. This simulation, as a result of the lower dispersivity, results in a higher maximum concentration of 46,000 mg/l, representing a dilution of approximately 16 percent. This simulation predicts pore-fluid concentrations to increase above background over an area of approximately 106,000 feet. The final simulation (Figure 7-13) utilized a coefficient of longitudinal dispersivity of one foot and predicts a still higher maximum concentration for the upwelling brine of 52,000 mg/l, representing only a five percent dilution, again impacting an area of approximately 2.5 acres. It should be noted that the model-predicted concentrations represent values

Model Predicted Pore-Fluid TDS Concentration (ppt)
at a Depth of 2.5 Feet Below Sea Floor
Coefficient of Longitudinal Dispersivity = 10.0 feet



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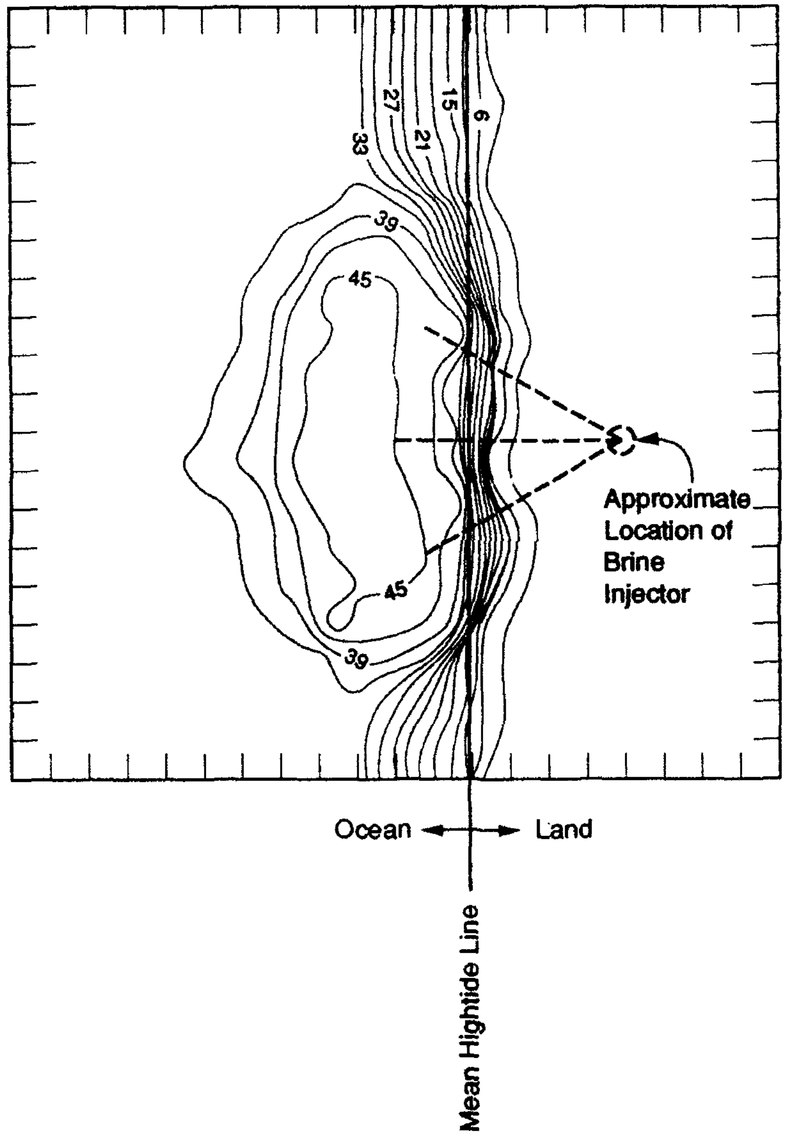
PREDICTED PORE-FLUID SALINITY CONTOURS (DISPERSIVITY = 5 FEET)

FIGURE 7-12

Model Predicted Pore-Fluid TDS Concentration (ppt)
at a Depth of 2.5 Feet Below Sea Floor
Coefficient of Longitudinal Dispersivity = 5.0 feet



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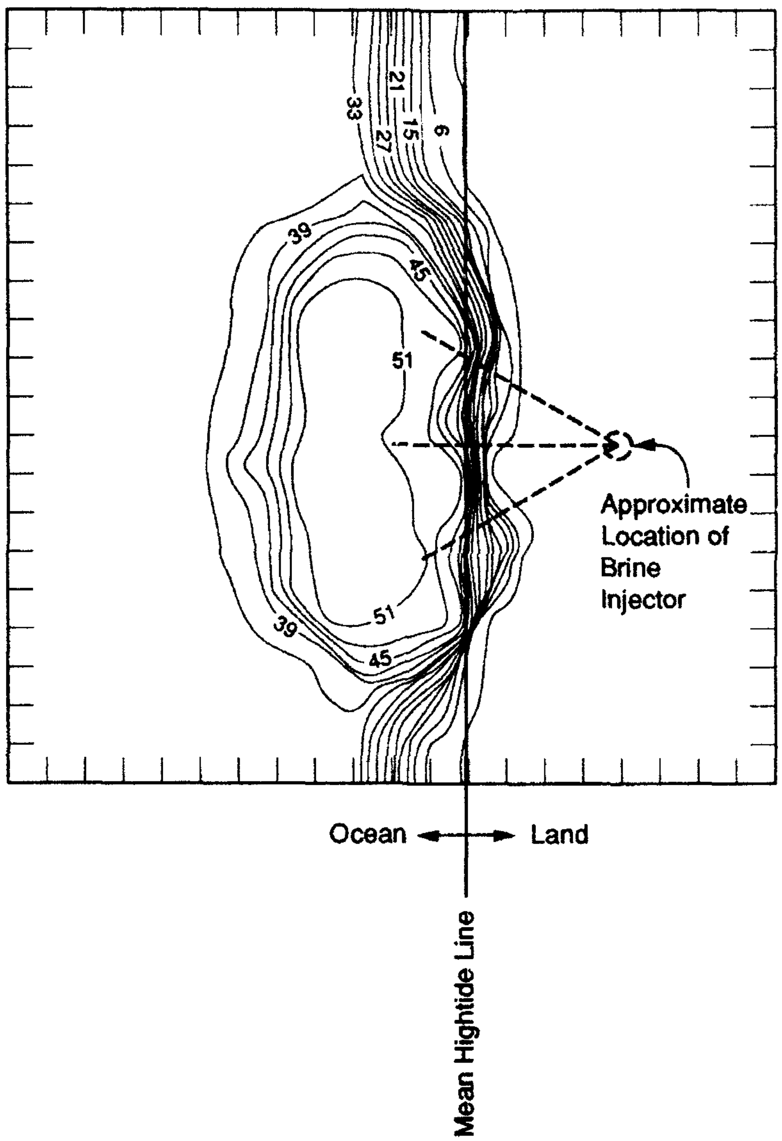
PREDICTED PORE-FLUID SALINITY CONTOURS
(DISPERSIVITY = 1 FOOT)

FIGURE 7-13

Model Predicted Pore-Fluid TDS Concentration (ppt)
at a Depth of 2.5 Feet Below Sea Floor
Coefficient of Longitudinal Dispersivity = 1.0 Feet



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at a distance of 2.5 feet below the sea floor. Concentrations at or just below the sea floor will be lower than the predicted values as the result of additional dispersion and diffusion along the final portion of the flow path. The degree of diffusion and dispersion in the final 2.5 feet is difficult to predict without a better understanding of the lithology and current patterns in the area of disposal. However, the results of the benthic survey indicate a highly turbid environment with sediments consisting solely of gravels and sands; therefore, essentially instantaneous dilution would be expected as the brine emerged from the ocean floor into the high energy environment of the nearshore waters of Monterey Bay. The solute transport model utilized one injector operating at 2.25 mgd. In practice, the proposed facility would utilize two injectors; predicted impacts are considered additive. The operation of two injectors would impact an area of approximately five acres of the sea floor. Overall, this impact would be considered less than significant.

The transport modeling suggests that dilution and spreading of the brine plume can be achieved as the result of movement through the aquifer system, even under the most conservative conditions. These results are consistent with the findings of a similar study designed to establish the degree of dilution occurring along a flow path as native ground water discharges into a lake through a sandy lake bed.[33] This study included the injection of a salt tracer into a sandy lake bed and the detection of the tracer at specific intervals along the flow path. The results showed dilution as great as 31 percent after a travel distance of 20 feet. The study also suggested that the degree of dilution was a function of the length of the flow path. The flow path length for a fluid injected under pressure is a function of the ratio of horizontal hydraulic conductivity to vertical hydraulic conductivity in the materials into which it is injected. As this ratio increases, fluid movement becomes increasingly horizontal, resulting in a longer flow path. The simulations performed above assumed a ratio of horizontal hydraulic conductivity to vertical hydraulic conductivity of two (i.e., horizontal being twice vertical). Again, the assumed value is considered a minimum value and is therefore conservative. If a higher value were utilized, the predicted sea floor concentrations would decrease as the result of a greater flow path length.

The injector laterals would underlie a portion of the ocean bottom that may be subject to temporary wave scour that could remove or deposit substantial volumes of material in the area overlying the laterals. Related to the issue of scour is the potential of the upwelling brine to "boil" (i.e., create seepage forces that exceed gravitation forces) the overlying sediments, resulting in the direct breakthrough of the discharged brine to the ocean. The potential for "boiling" is not considered likely

with the assumed amount of cover, since the maximum storm scour depth has not been known to exceed 8 to 10 feet, even in very severe storm events.[34]

Mitigation Measure 7.3.2-6

None required or recommended; however, monitoring of the aquatic community would be conducted as described in Section 8.5.

Impact 7.3.2-7

Desalination project construction could have adverse effects on water quality.

Grading and earthmoving activities, both at the proposed desalination plant site and along the pipeline routes, would expose disturbed soils to the erosive forces of wind and rain. This could in turn lead to sedimentation in the local stormwater drainage systems or in Monterey Bay. Earthmoving activities would be limited to construction of the pipelines and storage tank. In addition, the accidental spill of fuel or other hazardous substances could adversely affect local water quality. While construction activities would be temporary in nature, the impacts to water quality could last beyond the duration of construction, depending on the extent of degradation. Thus, these potential impacts are considered to be significant.

Mitigation Measures 7.3.2-7

(a) *Prudent construction practices would be employed at all times, recognizing the sensitivity of the coastal environment.*

(b) *To the extent feasible, grading, excavation and other earthwork would be confined to the dry seasons. When this is not feasible, erosion and sediment transport control facilities would be put in place prior to the onset of the first major winter storms (see 7.3.2-7[c] below).*

(c) *A detailed Erosion and Sedimentation Control Plan would be prepared by the project engineer, and would be submitted for review and approval by the MPWMD and Monterey County Department of Public Works. The specific language of such plans varies, but the concepts to be adhered to include the following:*

- *Project runoff would be discharged into small drainages at frequent intervals to prevent build up of large, potentially erosive flows.*

- *To avoid discharge to natural waterways, sediment would be trapped before leaving the construction site through the use of rip-rap, hay bales, siltation fencing, or sediment ponds.*
- *Areas of surface disturbance would be minimized.*
- *Disturbed areas would be stabilized through vegetative or mechanical methods; when construction is complete, all disturbed areas would be regraded and revegetated.*

(d) *Runoff from nonpoint sources, such as the desalination plant site, storage tank site, and pipeline routes, would be controlled so that it would not contribute sediment and turbidity to local water bodies. Reclamation activities, such as regrading and revegetation, would be implemented as soon as construction is complete in order to control erosion of disturbed material along the pipeline routes. Topsoil should be stockpiled and used for the revegetation of disturbed areas.*

(e) *A Spill Prevention Control/Countermeasure (SPCC) Plan would be prepared by the contractor and would be fully implemented prior to the start of construction. The SPCC Plan would cover actions needed to minimize the potential for accidental spillage of construction-related contaminants such as fuel, oil or other chemicals. Such contaminants would not be drained onto the soil; rather, they would be confined to sealed containers and removed to proper disposal sites. Refueling would be conducted in a location where spills could be contained.*

(f) *Debris and refuse would be removed from the site and disposed of in an approved sanitary landfill.*

(g) *Chemical toilets would be provided for the use of construction workers.*

Implementation of these mitigation measures would be expected to reduce the potential construction impacts to water quality to a less than significant level.

7.3.3 15,000 AF CAÑADA RESERVOIR WITH 3 MGD DESALINATION PLANT (15 CAN/D)

Impact 7.3.3-1

The 15 CAN/D alternative would result in extended periods of discontinuous flow in the Carmel River, similar to the No Project situation.

The 15,000 AF Cañada Reservoir combined with desalination (15 CAN/D) would result in extended periods of inadequate flow at the Narrows, similar to the No Project situation. Flow at the Lagoon with the 15 CAN/D alternative would provide an improvement over the No Project alternative, but would still entail two months of zero flow in normal years, and at least six months in dry (or worse)

conditions, similar to the No Project alternative. Overall, the impact is considered to be significant and adverse due to chronic periods of inadequate flow in the river. Please refer to Appendix 7-A for detailed information.

Flow at the Narrows. Under simulated conditions, flow at the Narrows with the 15 CAN/D alternative would exceed 5 cfs in seven out of 12 months in normal years, and six months in dry years (Figure 7-4). In normal years, the project would provide flows in the 2-9 cfs range from June through November, and 26-191 cfs in December through May. Flow at the Narrows with the 15 CAN/D alternative would be nearly identical to the No Project regime in the four year types studied. In critically dry and severe years, the flows with the 15 CAN/D alternative would be greater than 5 cfs in four out of 12 months (Figure 7-4). Flow would range from 1-4 cfs in May through December, and would range from 17-45 cfs from January through April.

Flow at the Lagoon. In normal years, there would be two out of 12 months without streamflow at the Carmel River Lagoon with the 15 CAN/D alternative (Figure 7-5); flow would be 5 cfs or greater in seven months per year (Figure 7-6). The number of months without flow would increase to six out of 12 months in dry years (Figure 7-5). Normal year flows with the 15 CAN/D alternative would be 0-7 cfs from June through December, and would entail an improvement over the No Project flows during some of those months. The 15 CAN/D alternative would result in flows of 29-171 cfs in January through May.

In critically dry years, flow to the Lagoon would cease to occur in eight out of 12 months compared nine months with the No Project alternative (Figure 7-5). Flows into the lagoon with the 15 CAN/D alternative would range from 1-14 cfs in January through April. There would be no flow to the lagoon for 11 months in a severe drought year, and the remaining month would entail a flow rate of only one cfs.

It should be noted that any reductions or increases in streamflow due to operation of the 15 CAN/D Project are governed by the bypass logic and rule proposed by CDFG (see Chapter 4). The 15 CAN/D alternative would not release any stored water to replenish groundwater storage or augment streamflows. Any water in excess of the bypass requirement at the diversion site for the Cañada Reservoir is stored and used exclusively for Cal-Am water supply.

Mitigation Measure 7.3.3-1

It is likely that this impact cannot be mitigated. The operation and design of Cañada Reservoir would need to be significantly altered to include releases of water from the reservoir into the river.

The CVSIM operations for the 15 CAN/D alternative entail the "modified baseload" operation suggested by the California Department of Fish and Game. A design that entails releases from Cañada Reservoir into the Carmel River would entail substantial engineering challenges. If implemented, river releases would also reduce the Cal-Am yield. Thus, the situation in the valley may not be mitigated. For these reasons, this would remain as an unavoidable significant impact.

Impact 7.3.3-2

The 15 CAN/D alternative would result in substantially more aquifer storage in lower Carmel Valley than the existing situation in most water years. Overall, this would be considered as a beneficial impact.

Under simulated conditions, normal year aquifer storage in lower Carmel Valley at buildout with the 15 CAN/D alternative would result in a *full aquifer year-round* (see Figure 7-7). In critically dry years, usable storage would range from 68 to three months with 100 percent of maximum, and average 86 percent (see Figure 7-8). In both cases, the 15 CAN/D alternative would provide moderate to substantially more storage than the No Project situation, especially in summer and fall. In severe drought years, aquifer storage with the 15 CAN/D alternative would be up to 13 percent less than with the No Project alternative (see Appendix 7-B).

Mitigation Measure 7.3.3-2

None necessary; this impact would be beneficial.

In severe drought years, average aquifer storage would be as low as 46 percent of maximum. This would not harm the aquifer as additional "unusable" storage remains below the perforations of well casings, and the project operations are designed to preclude seawater intrusion. However, low ground water levels in rare severe events could possibly impair water supply from shallow private wells near large Cal-Am municipal wells.

Impact 7.3.3-3

The 15 CAN/D alternative would result in lower groundwater levels in the Seaside Basin than the No Project situation in all water year types, but impacts would be considered as less than significant in most years. This alternative would entail more periods with zero or extremely low storage than other alternatives, which could have a potentially significant effect on the Seaside Basin.

Usable storage values for the Seaside Coastal Subbasin in normal years with the 15 CAN/D alternative would result in values ranging from 57 to 62 percent of maximum, and would average 58 percent capacity (Figure 7-9). There would be substantially less storage than with the No Project and other long-term alternatives. In critically dry years, the 15 CAN/D alternative would result in values ranging from 13 to 22 percent of maximum, and would average 16 percent capacity (Figure 7-10). Refer to Appendix 7-C for detailed information.

In simulated severe years, the 15 CAN/D alternative would entail periods of zero or extremely low storage at levels much lower than other alternatives studied. Also, inspection of the 90-year record indicates that the 15 CAN/D alternative would elevate the risk of seawater intrusion more often than other alternatives (five extended periods compared to one period). Because the impact of extended periods of very low storage has not been conclusively determined, and the fact that the Seaside Basin has been heavily pumped in the past, this impact is considered potentially significant.

Mitigation Measure 7.3.3-3

The potentially significant impact to the Seaside Coastal Subbasin can be mitigated to a less than significant level by reduced pumping if monitoring indicates such a need. Please see the discussion under Mitigation Measure 7.3.1-3.

All alternatives would entail a period of zero storage in simulated years 1990-91 at buildout; the 15 CAN/D alternative would entail four other extended periods with zero storage as well. If monitoring determines a need for reduced pumping, the situation can be corrected to a less than significant level. Water supply yield would be reduced unless supply came from other sources; additional pumping from Carmel Valley is not recommended as it would exacerbate the streamflow impacts described in Impact 7.3.3-1 above.

Impact 7.3.3-4

Operation of the 15 CAN/D alternative could affect channel capacity from the diversion point downstream to the Carmel River Lagoon.

Operation of the 15 CAN/D alternative would not affect the river flow except in the area of the diversion point, which is located at river mile 5.6, and the channel downstream, and therefore would not have the potential to narrow the channel at upstream locations. As shown in Table 7-6, flood frequency downstream of the diversion point is not changed appreciably, although sediment accumulation during sequential years of relatively small storm flows could cause channel narrowing. Most likely, any accumulated sediments would be flushed downstream by subsequent storm flows, and any vegetation established within the channel would be removed. However, there exists a small potential for vegetation to become permanently established on sand bars. This is unlikely, however, because during these critically dry periods, the water table is usually not high enough downstream of the diversion to support the growth of young willows during the critical summer and fall months. Therefore, this impact would be less than significant.

Mitigation Measures 7.3.3-4

None necessary; this impact would be less than significant.

Impact 7.3.3-5

Diversion of streamflow for pumping to the Cañada off-stream reservoir may result in the accumulation of sediment at and downstream of the diversion point, potentially affecting channel stability and the ability of anadromous fisheries to migrate upstream at low flows.

The 15 CAN/D alternative would provide a storage capacity of approximately 15,000 AF in a tributary canyon of the Carmel River along the north side of Carmel Valley. The reservoir would be filled by diversion of Carmel River streamflow at about river mile 5.6 and then pumped from the diversion point to the reservoir. The diversion would be accomplished by an infiltration gallery installed under the channel bottom in a gravel bed. The maximum rate of diversion would be 100 cfs. With the location of the diversion point far downstream compared to other alternatives, many of the potential impacts to sediment transport described for the other alternatives involving dam construction would not be applicable to the 15 CAN/D alternative.

River flow at Robles del Rio would be unaffected by this alternative, and consequently no impacts to the sediment transport capability of the river at this location would be expected. Furthermore, because the diversion point is downstream of all important tributaries (except Potrero Creek, which produces only small amounts of sediment), this alternative would not result in an increased potential for sedimentation impacts from tributaries, compared to the No Project alternative. The potential for sediment transport into the lagoon during critically dry periods could cause a reduction in the lagoon volume.

However, the 15 CAN/D alternative could have at least one potentially significant impact on sediment transport. The essentially instantaneous diversion of 100 cfs during storm flows would result in a reduction in the river's ability to transport sediment below the diversion point. This could tend to result in the accumulation of sediment, primarily bedload (sand and larger grain sizes), at and downstream of the diversion point.

While it is likely that most of the suspended load would still be transported by the reduced streamflows, much of the bedload could be deposited. Subsequent storm flows could tend to rework these deposits, possibly moving them slowly downstream in slugs of sediment. These slugs of sediment could lead to channel instability by redirecting river flows and could potentially lead to the creation of migration barriers, such as critical riffles, for anadromous fisheries. Sediment accumulation would depend on the upstream sediment supply. If continued bank erosion occurs along the river between Carmel Valley Village and the diversion point, substantial sediment would be available for accumulation. This would be considered a potentially significant impact.

Mitigation Measures 7.3.3-5

There are two possible mitigation measures for this impact: (1) diversions could be periodically stopped during high flow periods to allow any accumulated sediment to flush downstream; or (2) accumulated sediment could be removed downstream of the diversion point during critically dry periods.

The magnitude and duration of unimpaired streamflows that would be necessary to flush various amounts of sediment accumulation through the system have not yet been analyzed; however, given the impacts this type of operation could have on the water supply performance of the alternative, it could well be more cost-effective to physically remove any sediment accumulation.

Removal operations would only be conducted during periods when the river was critically dry at the diversion, which occurs over 50 percent of the time in August, September, and October. Given the small gravel and sand bed nature of the streambed in this area, with proper techniques, removal could be accomplished with a less than significant effect on the river environment. Such techniques would involve reestablishment of the low-flow channel and replacement of the natural gravel layer on the streambed after completion of the operation. Implementation of this measure would reduce the potential impacts from sedimentation to a less than significant level.

Impact 7.3.3-6

Operation of the 3 MGD desalination plant in Sand City would affect groundwater hydrology and marine water quality.

Please refer to the discussion of impacts 7.3.2-5 and 7.3.2-6 for a discussion of the impacts of the 3 MGD desalination plant on groundwater hydrology and marine water quality. Both of these impacts are considered less than significant.

Mitigation Measure 7.3.3-6

None required or recommended; however, monitoring of the aquatic community would be conducted as described in Section 8.5.

7.3.4 7 MGD DESALINATION PROJECT (7 DSL)

Impact 7.3.4-1

The 7 DSL alternative would result in extended periods of discontinuous flow in the Carmel River, similar to the No Project situation.

The 7 MGD Desalination alternative (7 DSL) would result in a streamflow regime that is nearly identical to the No Project scenario. Even in normal years, there would be extended periods of intermittent flow above the Narrows, and flow would cease in the lower Carmel River for five months. In dry (or worse) years, flow in the lower river would cease for most of the year. Thus there would be a significant adverse impact to streamflow. This is similar to the existing situation, which entails extensive dewatering in most years (see Appendix 7-A).

Flow at the Narrows. The flow regime at the Narrows with the 7 DSL alternative would be nearly identical to that described for the 15 CAN/D alternative under Impact 7.3.3-1, and to the No Project alternative. Flow would be adequate in 4-7 months of the year, depending on the year type (Figure 7-4).

Flow at the Lagoon. The flow regime at the Lagoon with the 7 DSL alternative would be nearly identical to that of the No Project situation (Figures 7-5 and 7-6). In normal years, there would be five out of 12 months without streamflow at the Carmel River Lagoon with the 7 DSL alternative (Figure 7-5); flow would be 5 cfs or greater in six months per year (Figure 7-6). The number of months without flow would increase to seven out of 12 months in dry years (Figure 7-5). Normal year flows with the 7 DSL alternative would be 0-5 cfs from June through December, and would be nearly identical to the No Project flows. The 7 DSL alternative would result in flows of 19-182 cfs in January through May.

In critically dry years, flow to the Lagoon would cease in nine out of 12 months, the same as with the No Project alternative (Figure 7-5). Flows into the lagoon with the 7 DSL alternative would range from 8-13 cfs in February through April. There would be no flow to the lagoon for 11 months in a severe drought year, and the remaining month would entail a flow rate of only one cfs.

It should be noted that all reservoir releases for streamflow with the 7 DSL Project are governed by current District practices and ordinances (see Chapter 4). These include Regulation X of the District Rules and Regulations and a Memorandum of Agreement (MOA) between Cal-Am, the District, and CDFG. These rules are designed to balance water supply needs and environmental requirements. More specifically, the MOA is structured to maximize streamflow from San Clemente Dam to the Narrows from April through November.

Mitigation Measure 7.3.4-1

This impact is unmitigable unless substantial increases in the size of the desalination plant were made, or if a reservoir was combined with the 7 MGD plant. The cost of such actions would be prohibitive.

The size of the desalination plant would need to increase substantially before it could reduce the adverse impacts on streamflow in the Carmel River at buildout. It is questionable whether such a large plant would be economically feasible. Another option is to build a small reservoir, primarily for

flow releases in critically dry periods. (The 7 MGD desalination plant could adequately meet all water supply needs.) The cost of such a combination would be prohibitive, and changes the very meaning of the "non-dam" alternative. For these reasons, this would remain as an unavoidable significant impact.

Impact 7.3.4-2

The 7 DSL alternative would result in usable storage in Carmel Valley in most years at levels slightly greater than the existing situation.

The simulated normal year aquifer storage in lower Carmel Valley at buildout with the 7 DSL alternative would result in a full aquifer from February through April, and would fall to 75 to 78 percent of maximum in September through November. The average annual storage would be 90 percent of maximum (see Figure 7-7). In critically dry years, usable storage with 7 DSL alternative would range from four months at 67 to 69 percent of maximum to a peak of 99 percent in April, and would average 81 percent (see Figure 7-9). In both cases, the 7 DSL would provide a small increment of increased storage than the No Project alternative. In severe droughts, however, the 7 DSL would provide substantially greater storage than the No Project alternative (see Appendix 7-B).

Mitigation Measures 7.3.4-2

None necessary; there would be a modest benefit compared to the existing situation.

Impact 7.3.4-3

The 7 DSL alternative would have a beneficial impact on groundwater levels in the Seaside Basin as it would result in somewhat greater aquifer storage than the No Project alternative in all water year types evaluated.

Impacts would be similar to those described for the 24 NLP alternative (see Impact 7.3.1-3). Usable storage values for the Seaside Coastal subbasin in normal years with the 7 DSL alternative would result in values ranging from 71 to 77 percent of maximum, and would average 74 percent (see Figure 7-9). There would be more storage than with the No Project in all water years (see Appendix 7-C). In critically dry years, the average annual usable storage would be 39 percent of maximum (see Figure 7-10), and would range from 34 to 45 percent capacity.

Mitigation Measure 7.3.4-3

None needed. See discussion under Mitigation Measure 7.3.1-3.

Water levels and chloride concentrations would be monitored. If the monitoring indicated that there was a threat of seawater intrusion, then pumping would be curtailed and the subbasin would be allowed to recharge to provide a further safeguard.

Impact 7.3.4-4

Operation of the 7 MGD desalination plant would have no impact on Carmel River channel capacity or flood elevations.

As shown in Table 7-6, the 7 DSL alternative would have no effect on the flow frequency of the Carmel River, and there would be no impacts on channel capacity or flood elevations.

Mitigation Measure 7.3.4-4

None necessary; there would be no impact.

This alternative could affect sediment transport in almost an identical manner as the No Project alternative. Slightly greater amounts of bedload could be transported to the lagoon by this alternative due to slightly increased flows in the lower river, because not as much groundwater pumping would occur. However, the magnitude of this increase is probably not measurable under actual field conditions, and no mitigation measures would be necessary.

Impact 7.3.4-5

Operation of the 3 MGD desalination plant in Sand City would affect groundwater hydrology and marine water quality.

Please refer to the discussion of impacts 7.3.2-5 and 7.3.2-6 for a discussion of the impacts of the 3 MGD desalination plant on groundwater hydrology and marine water quality. Both of these impacts are considered less than significant.

Mitigation Measure 7.3.4-5

None required or recommended; however, monitoring of the aquatic community would be conducted as described in Section 8.5.

Impact 7.3.4-6

Disposal of the brine produced during the desalination process through the MRWPCA outfall would affect water quality.

For the MRWPCA plant site alternative, the brine would be blended with treated wastewater effluent and discharged to Monterey Bay through the existing MRWPCA outfall. There are two issues of environmental concern related to water quality. Depending on the proportions of the blend, the discharge may be more saline than the ambient seawater, in which case it would cause a local elevation of salinity in the vicinity of the diffuser; the effects of this discharge on marine organisms is addressed in Chapter 8. Also, because the addition of brine to the treated effluent discharge increases the overall density of the discharge, it would lead to a change in the initial dilution achieved by the outfall diffuser, in some situations reducing the overall initial dilution of wastewater effluent.

To address the possible water quality impacts of the brine discharge, an initial dilution analysis was performed. The results of this study are summarized in this section; the entire report is available for review at the MPWMD offices.[35] Numerical models designed to simulate the behavior of underwater jets and plumes were used to estimate effective effluent initial dilution and the change in salinity in the vicinity of the outfall, under a full range of possible future operation conditions. The performance of the outfall under existing conditions, i.e. with no added brine and no wastewater reclamation, was also estimated to provide a basis for comparison.

After extensive testing and comparison of several models, one model developed at EPA by Walter Frick, known as "UM3," was selected for this study. Several comparisons between UM3 and other models showed good agreement for a selection of the rising plume cases encountered in this study. A range of cases from no reclamation to full reclamation were analyzed for blending with the brine discharge. The 10 levels of reclamation analyzed were: 0, 20, 40, 60, 70, 80, 90, 95, 98 and 100 percent.

During the design phase for the MRWPCA treatment plant, extensive field measurements were taken in the general area of the outfall.[36] The quality characteristics of the receiving water were measured at nine locations in eight surveys spanning 14 months. From these available data, two density profiles were selected from the survey location nearest to the outfall site for this study to represent summer and winter conditions. The summer profile was selected, from the available profiles, to provide a "worst case" condition for initial dilution.

In addition to the scenarios listed above, the two existing configuration cases were analyzed, with the current level of effluent discharge (18 MGD), and the chosen winter and summer ambient density profiles.

Method of Analysis

The jet/plume model UM3 was designed to simulate the behavior of effluent discharged from a multiport diffuser. The transition from individual plumes, in the early stages, to the merging of the plumes to eventually create a uniform field of effluent, is simulated in this model. Following conventional practice, the results reported here as initial dilution values, for buoyant plume cases, are the average plume dilution levels at the trapping level, *i.e.* at the point where the plume average density equals the ambient seawater density for that depth.

For the proposed project, the blended effluent is less dense than the ambient seawater over a range of wastewater reclamation levels, but at high levels of reclamation (greater than approximately 85 percent), the blended effluent is more dense than the ambient seawater, and therefore the plume falls rather than rises.

The model UM3 simulates the trajectory and mixing of a falling plume only up to the point that the jet/plume reaches the bottom. Further dilution would occur as the velocity of the jet/plume continues to cause entrainment of seawater, but UM3 cannot estimate dilution beyond this point. The dilutions predicted in this study for the dense plume cases are in this respect conservative.

After the initial dilution of the blended effluent was computed using UM3, the net wastewater dilution and the salinity at the edge of the zone of initial dilution were calculated by factoring in the effects of blending treated wastewater and brine. The net wastewater dilution was simply found as the product of the initial dilution generated by the diffuser and the predischarge dilution caused by

adding the brine to the wastewater. The salinity at the edge of the zone of initial dilution was computed by adding the salt contributions from the brine and from the ambient seawater that dilutes the blended effluent. The salinity results were expressed in terms of a percentage of ambient seawater salinity.

Results

Existing Conditions. Effluent initial dilutions were predicted for the existing MRWPCA treatment plant flow of 18 MGD, under the assumed winter (November 75) and summer (July 76) ambient conditions. The predicted initial dilution was 248:1 in winter and 121:1 in summer.

Desalination and Reclamation Scenarios. The initial dilution predictions for the 20 scenarios from the plume simulation alone - i.e., without taking into account the predischarge dilution of the waste-water by brine - together with the net effective wastewater initial dilutions are listed in Table 7-9.

The results of the 20 cases simulated are presented in graphical form in Figure 7-14 for winter (November 75) and summer (July 76) ambient density conditions respectively. Each figure shows both the effective wastewater effluent initial dilution and the salinity level at the edge of the zone of initial dilution as a function of percentage of wastewater reclamation. On each plot, the effective effluent (average) initial dilution is shown with a solid line, as a function of the percentage of wastewater reclamation. On the same plot, the salinity at the edge of the zone of hydrodynamic mixing, or zone of initial dilution (ZID), expressed as a percentage of ambient seawater salinity, is shown with a dashed line. The dotted line on each plot at the initial dilution level of 121 indicates the "existing worst case" dilution of 121:1 predicted for the outfall under existing conditions, using the summer density profile.

In the horizontal plane, the ZID associated with these plume dilution estimates is an approximately rectangular region centered on the diffuser line. Roughly speaking, only within this region will effective effluent dilutions fall below the levels in Figure 7-14 (or, equivalently, will plume dilutions exceed the levels in Table 7-9). The long side of the rectangle is in all cases roughly equal to the length of the diffuser, or about 1,000 feet. The width (short side of the rectangle) of the ZID varies widely, depending mainly on whether the plume is positively or negatively buoyant. The width of the ZID for the 3 MGD desalination plant cases modeled with the summer density profile is given in Table 7-9.

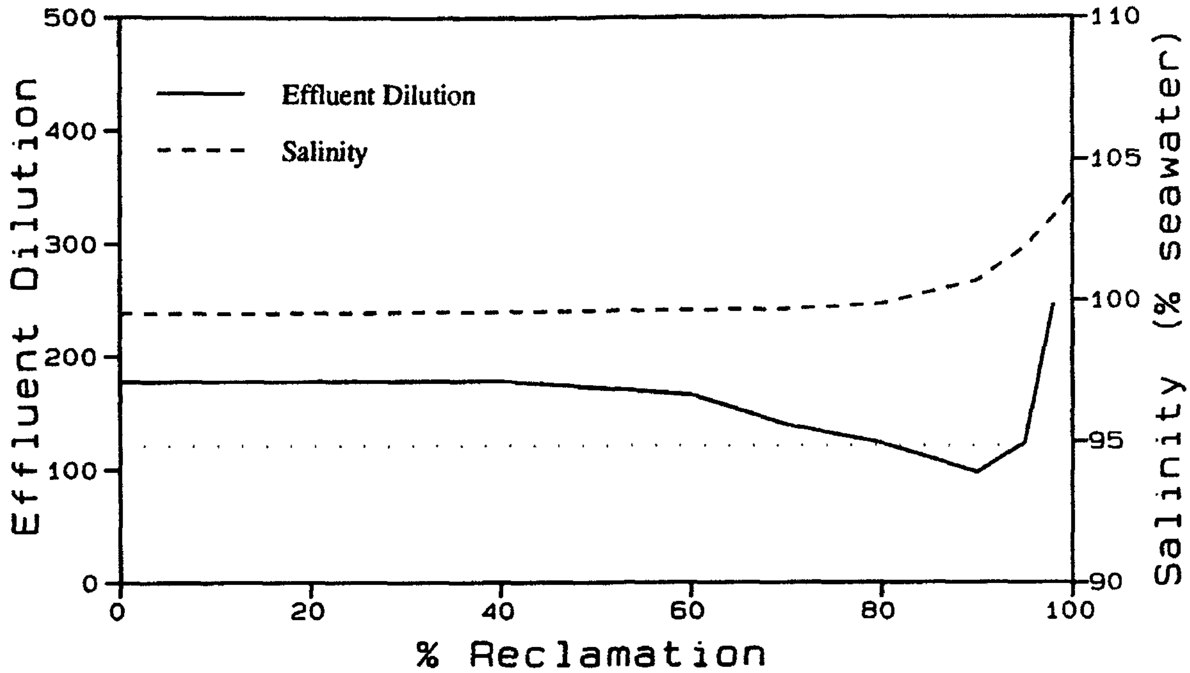
TABLE 7-9

INITIAL DILUTION VALUES FOR VARIOUS RECLAMATION LEVELS, MRWPCA ALTERNATIVE

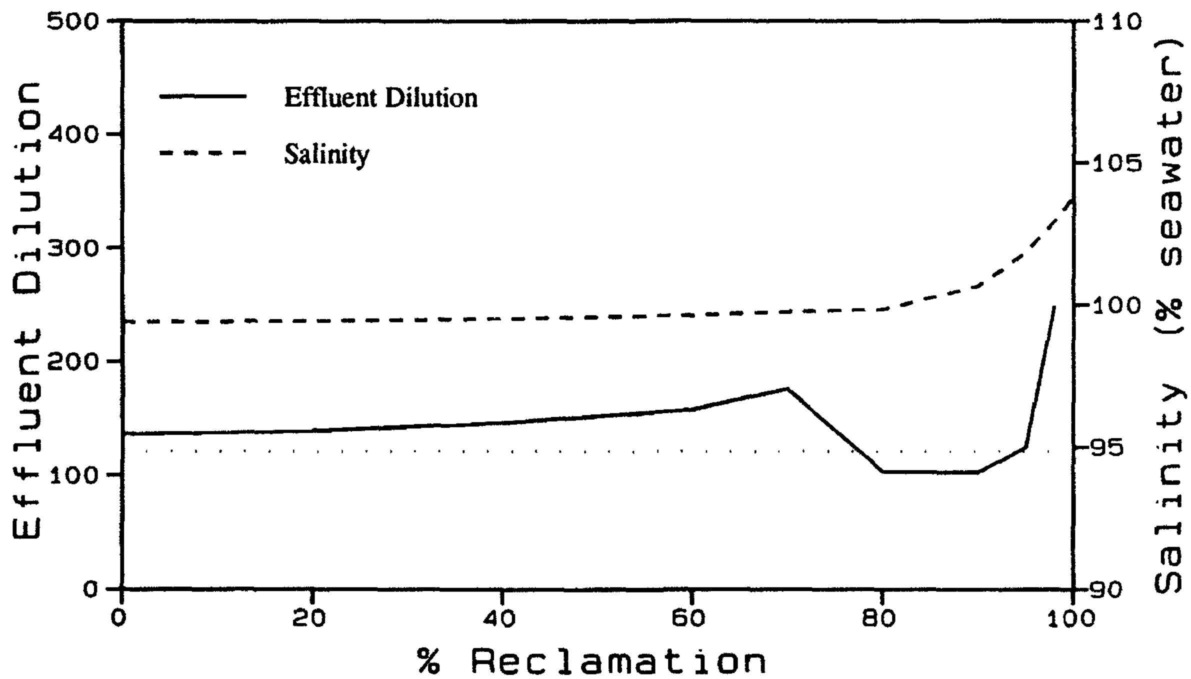
	Winter Conditions		Summer Conditions		
Percent Reclamation	Plume-Only Dilution[1]	Effective Initial Dilution of Wastewater[2]	Plume-Only Dilution[1]	Effective Initial Dilution of Wastewater[2]	Width of ZID, ft.[3]
0	142	178	109	136	53
20	136	179	106	139	46
40	126	179	103	146	43
60	102	166	97	158	39
70	76	140	96	176	43
80	55	123	46	104	30
90	28	97	29	103	20
95	21	124	21	125	13
98	18	246	19	249	10
100	17	---	17	---	10

[1]Computed using UM3.
[2]Combination of plume dilution and predischarge dilution.
[3]Zone of initial dilution; the length of the ZID would be about 1,000 feet.

Source: Water Engineering and Modeling.



A. Winter Conditions



B. Summer Conditions

SOURCE: WATER ENGINEERING AND MODELING

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Discussion of Results

The plume-only initial dilutions presented in Table 7-9 indicate that addition of brine to the wastewater effluent reduces the dilution performance of the outfall. This is a direct consequence of the increased density of the blended effluent. The denser effluent is trapped at a lower level in the water column, and therefore the mixing length - the distance over which seawater entrainment occurs - is reduced. When the predischarge dilution achieved by blending the brine with the wastewater is factored in, giving the net dilution values in Table 7-9, the effective wastewater dilution is increased, in most of the summer cases to a higher level than is achieved under existing conditions.

Both winter and summer conditions show the same general pattern of variation of effluent dilution and salinity. As long as the blended effluent is less dense than the ambient seawater, the increasing level of reclamation does not dramatically affect the initial dilution of the effluent, as the predischarge dilution effect counteracts the reduction in plume dilution that usually results. When the level of reclamation reaches the point at which the blended effluent density exceeds the density of the ambient seawater, the plume dilution drops, usually pulling the effective dilution down. The dilution of a negatively buoyant plume is low because the plume descends quickly to the bottom and thereafter experiences little additional dilution. At high reclamation levels the predischarge dilution by the brine is dominant, causing a rapid increase in effluent dilution as the proportion of wastewater in the blend goes to zero.

The salinity of the plume is very close to ambient seawater salinity over the buoyant-blend range of reclamation percentage; this is to be expected because for these cases the plume reaches a trapping level, at which time it has the same density as the ambient seawater. When the blended effluent becomes denser than the ambient seawater, the plume hits the ocean bottom before it is trapped, and consequently it is more dense and more saline than the ambient seawater. The increase in plume salinity continues as reclamation is increased, to a maximum at 100 percent reclamation when straight brine is discharged. The highest elevation in salinity is about 3.5 percent with the 4 MGD desalination plant. The diffuser achieves relatively low dilutions with the lower flows associated with full reclamation because the associated lower jet velocities lead to lower entrainment. The dilution predictions for very low flows must be treated as approximate because at low flow levels, hydraulic effects in the diffuser caused by the change in elevation from one end to the other will create unbalanced flow through the ports.

Conclusions

Effective wastewater effluent dilution levels were predicted for a desalination plant capacity of 4 MGD, for winter and summer ambient water column density profiles. A total of 20 scenarios were simulated, with wastewater reclamation level ranging from 0 percent to 100 percent. The anticipated operating modes for the wastewater treatment plant are 10 percent to 20 percent reclamation in winter and 100 percent reclamation in summer. For the winter mode, predicted effective initial dilution of the wastewater effluent is 173:1 with the 4 MGD desalination plant; this level of initial dilution, while below the predicted value of 248:1 for the situation without brine, is still well above the 121:1 that the outfall is predicted to achieve under existing conditions with the summer density profile used in this study.

For the summer mode, discharging undiluted reject brine (corresponding to 100 percent reclamation) through the MRWPCA outfall results in an estimated salinity of 35,800 mg/l after an initial dilution of 17:1, as compared to an ambient salinity of 34,500 mg/l, an increase of 3.5 percent over ambient conditions. These salinity elevation results are computed at the limit of the zone of initial dilution, which for the dense plume cases is within a few meters of the outfall. The negatively buoyant plume would have a tendency to spread out along the bottom and flow downhill. Further dilution of the plume would depend on the ambient currents: the tidally generated currents that are always present, and the varying currents associated with long-shore flow and turbulent eddies with a range of scales.

Because this increase in salinity would not result in the violation of any effluent limitations, and because the existing salinities in Monterey Bay can vary from about 33,000 mg/l to 36,000 mg/l, this impact is considered to be less than significant. The effects of this discharge on marine life are discussed in Chapter 8.

Mitigation Measure 7.3.4-6

None required or recommended.

Impact 7.3.4-7

Operation of the Ranney collectors would alter groundwater hydrology.

The two proposed Ranney collectors would be separated by a distance of about 500 feet. Each collector would produce about 5.0 MGD, for a total production of 10.0 MGD of raw seawater. The drawdown of the aquifer at this rate of pumping is estimated to be about 27 feet in the immediate area of the collectors, decreasing to about 11 feet at a distance of 750 feet from the collectors.[37] This localized depression of the water surface would, as intended, induce the landward flow of seawater. This landward flow would then be captured by the collectors. During periods when the collectors are idle, the normal seaward flow of groundwater would resume.

While the existing TDS level of the aquifer is about 22,300 mg/l, it is expected that during continuous production, the salinity would likely approach that of seawater (34,500 mg/l). This would be due to the inducement of seawater flow landward. However, this would not be expected to affect the salinity levels of any other wells because the seawater induced landward would be captured by the collectors, and no large scale shift in groundwater flow would occur as a result of the proposed project. The proposed Ranney collectors would therefore have a less than significant impact on groundwater hydrology and water quality.

Mitigation Measure 7.3.4-7

None required or recommended.

7.3.5 NO PROJECT ALTERNATIVE (NO PRJ)

Impact 7.3.5-1

The No Project alternative would result in extended periods of discontinuous flow in the Carmel River.

Even in normal years, the No Project would result in extended periods of intermittent flow above the Narrows, and flow would cease to occur in the lower Carmel River for five months. In dry periods, flow in the lower river would cease for most of the year. The No Project alternative differs from the four long-term water supply alternatives because demand is constrained to a maximum of 17,359 AF Cal-Am annual production. Even at this reduced demand, there would be a significant adverse impact to streamflow.

Flow at the Narrows. As shown in Figure 7-4, the No Project alternative would provide nearly identical flows to those described for the 15 CAN/D alternative under Impact 7.3.3-1. Flow would be adequate in 4-7 months of the year, depending on the year type.

Flow at the Lagoon. As shown in Figure 7-5, the No Project alternative would provide nearly identical flows to those described for the 7 DSL alternative under Impact 7.3.4-1. Flow would cease in 5-11 months of the year, depending on the year type.

It should be noted that all reservoir releases for streamflow with the No Project alternative are governed by current District practices and ordinances as described for the 7 DSL alternative above.

Mitigation Measure 7.3.5-1

None available; this alternative would have an unavoidable significant impact to streamflow.

A project that results in flow releases greater than ground water pumping in the Carmel River is the only means of mitigating the significant adverse effects on streamflow for the No Project (existing) situation. By definition, the No Project would not entail such facilities. The level of normal year demand needed to preclude streamflow impacts would not be feasible unless extensive, severe, permanent rationing were imposed on the existing population. Even modest growth would be precluded. For these reasons, this impact remains as significant and unavoidable.

Impact 7.3.5-2

The No Project alternative would always result in at least 52 percent of maximum usable storage in Carmel Valley. This would be considered as a less than significant impact.

The No Project alternative differs from the previous alternatives in that demand is limited to 17,359 AF annual Cal-Am production. The simulated normal year aquifer storage in lower Carmel Valley with the No Project alternative would result in a full aquifer from February through April, and would fall to 73 to 77 percent of maximum in September through November. The average annual storage would be 89 percent of maximum (see Figure 7-7). In critically dry years, usable storage would range from four months at 64 to 68 percent of maximum to 96 percent in March and April, and would average 79 percent (see Figure 7-8). See Appendix 7-B for detailed information.

Mitigation Measures 7.3.5-2

None necessary; this would be a less than significant impact.

Impact 7.3.5-3

In most years, the NO PRJ alternative would have a less than significant impact on groundwater levels in the Seaside Coastal Basin.

Usable storage values for the Seaside Coastal Subbasin in normal years with the No Project alternative would range from 67 to 73 percent of maximum, and would average 71 percent capacity (Figure 7-9). Storage levels would be somewhat less than with the long-term alternatives, except for the 15 CAN/D alternative, in all year types.

In critically dry years, usable storage would range from 31 to 40 percent of maximum, and would average 35 percent capacity (Figure 7-10). As described for the 24 NLP alternative, there would be rare periods with extremely low storage in severe droughts.

Mitigation Measure 7.3.5-3

None needed. See discussion under Mitigation Measure 7.3.1-3.

Impact 7.3.5-4

The No Project alternative would have no impact on Carmel River channel capacity or flood elevations.

As shown in Table 7-8, the No Project alternative would have no effect on the flow frequency of the Carmel River, and there would be no impact on channel capacity or flood elevations.

Mitigation Measure 7.3.5-4

None necessary; there would be no impact.

There would be no substantial difference between No Project and existing conditions regarding sediment transport and channel stability; thus, no mitigation measures are necessary.

7.4 SUMMARY OF HYDROLOGIC IMPACTS

Streamflow at the Narrows

In normal years, flow for all alternatives would be generally greater than 20 cfs from December through May. However, only the 24 NLP and 24 NLP/D alternatives would provide adequate flow (5 cfs or more) throughout the year in normal and dry conditions. The 24 NLP/D alternative is the only project to provide year-round flow greater than 5 cfs in critically dry conditions, though the 24 NLP alternative is a close second with 10 out of 12 months of adequate flow. The 15 CAN/D, 7 DSL, and No Project alternatives would perform similarly (and poorly), and would result in 5-8 months per year of flow less than 5 cfs, depending on the year type.

Streamflow in the Lower Carmel River

Only the two large mainstem dams (24 NLP and 24 NLP/D) would provide year-round flow in the lower Carmel River in normal and dry conditions (actually 11 months for the 24 NLP). The 7 DSL and No Project would result in zero flow for 5-11 months, depending on the year type, resulting in a chronic adverse impact. The 15 CAN/D would result in a modest improvement, with two months without flow in normal years, and 6-11 months without flow in the remaining water year types.

Aquifer Storage in Upper Carmel Valley

All water supply alternatives would result in full aquifers throughout normal and critically dry years. This area would not be impacted except in the most severe droughts.

Aquifer Storage in Lower Carmel Valley

Simulated average storage at buildout for all alternatives result in less than significant or beneficial impacts compared to the No Project (existing) situation. In normal years following the infrequent droughts when storage would be reduced, the aquifer would recharge in winter. In most years, the three reservoir projects would result in substantial benefits, especially in summer and fall, compared to the No Project situation. The 7 DSL alternative would provide aquifer storage similar to the existing situation, although it would improve storage in severe conditions.

Aquifer Storage in Seaside Coastal Subbasin

All alternatives, except the 15 CAN/D alternative, would perform similarly at buildout, and average about 71-74 percent of maximum storage in normal years. In critically dry years, average usable storage would be about 35-40 percent of maximum. The 15 CAN/D alternative would provide much less storage in all year types. The normal year average storage would be 58 percent of maximum; average storage in a critically dry year would be 16 percent of maximum.

All alternatives would result in some months with less than five percent or even zero storage in sustained, severe droughts such as the 1990-91 period. This situation would occur more often with the 15 CAN/D alternative. Thus, monitoring for seawater intrusion would be necessary, along with reductions in pumping, if needed to reduce risk. Storage with all these alternatives would return to acceptable levels in normal years following droughts.

Channel Geometry and Sediment Transport in the Carmel River

The alternatives that have the capability to store large amounts of streamflow could potentially produce the greatest impacts on streamflow and, therefore, channel geometry and sediment transport. Alternatives that do not involve mainstem storage would not have any appreciable impact as compared to the No Project. Given the variability known to exist in sediment transport rates and the complex interaction of variables that affect sediment supply and movement, it is difficult to quantify the expected impacts of these alternatives. Yet, there is little doubt that the alternatives involving dam construction on the Carmel River could cause potentially significant changes to the Carmel River channel. Properly managed, using the mitigation measures described, these potential changes in channel geometry would not likely be significant. The mainstem reservoir benefits include the improved likelihood of channel stability resulting from increased vegetation, as described in Chapter 9.

7.5 IMPACTS OF PROJECT OPERATION ON WATER QUALITY

7.5.1 RESERVOIR ALTERNATIVES

Impact 7.5.1-1

Impoundment of water behind the New Los Padres Dam could alter downstream water quality.

When a free-flowing stream is impounded, a change occurs from a flowing water environment to an essentially standing or lake water environment. The change in water temperature or heat distribution within the impoundment is one of the most important, yet less obvious alterations. More than any other environmental change, this one factor largely determines what takes place biologically, che ically and physically within the reservoir.[38]

Solar energy reaching the reservoir surface heats the upper layer of water in a lake. This heat is distributed by wave action, which creates turbulence that mixes the water to varying depths. The distribution of heat throughout the water column affects the density of the water and leads to the development of thermal stratification. In a typically stratified lake, the upper region is referred to as the epilimnion, and is characterized by fairly warm, well-mixed and well-oxygenated waters. Below the epilimnion is a region of rapid temperature change, known as the thermocline. Below the thermocline is a region of cold, deep and relatively undisturbed water, the hypolimnion. The difference in temperature between the epilimnion and the hypolimnion can be in excess of 15 to 20 degrees centigrade.[39]

One of the most important water quality implications of reservoir stratification is the effect on dissolved oxygen (DO) levels. Thermal stratification creates a density barrier that effectively cuts off the hypolimnion from the atmosphere, thus preventing reoxygenation. The epilimnion remains well-oxygenated and tends to support abundant algal growth. These organisms then die and settle through the water column to the hypolimnion. This organic matter combines with other organic matter in the hypolimnion and sediments to exert an oxygen demand via decomposition; eventually, the DO level can drop to zero at the bottom and very low levels in much of the hypolimnion. Biochemical oxygen demand is often greatest during the first few years after impoundment because of the amount of organic matter contained in the reservoir inundation area.

In addition to low temperature and DO, waters of the hypolimnion tend to be high in iron, manganese, nutrients and hydrogen sulfide associated with anaerobic conditions at the sediment-water interface. Therefore, the water of highest quality in the thermally stratified reservoir is usually found in the layer just below the thermocline at the top of the hypolimnion.[40]

The proposed reservoirs would begin to stratify at the end of the rainy season, typically in early April, and this stratification would be complete by June 1 of any given year, but the inflow to the reservoir

would be cool water. This stratification would continue through the summer, with the temperature of the epilimnion continuing to increase as the reservoir is drawn down through the summer months. The depth of the epilimnion is estimated to be 30 feet, based on studies of other reservoirs in the region.

Upon the arrival of the first large winter storms, the volume of inflow to the reservoir would often be large compared to the storage volume, and the reservoir would be completely mixed throughout the water column. This mixing would continue for the duration of the rainy season, with no wintertime stratification occurring and the water quality within the reservoir being essentially the same as that of the inflow. As the winter rains ended, the inflow to the reservoir would decrease and the lake would stabilize and again begin to stratify, thus beginning another annual cycle.

The temperature and DO content of the reservoir waters would have a direct effect on the characteristics of the waters released downstream, depending where in the water column the release takes place. Improper design or operation of a reservoir alternative could have potentially significant impacts on water quality downstream of the dam. The 15 CAN/D alternative would have no effect on Carmel River water quality because this alternative would not discharge water to the river. Water temperature effects on fish are discussed in Chapter 8, while water quality effects on humans are discussed in Chapter 15.

Mitigation Measures 7.5.1-1

(a) *During the warm-weather months (April to November), water should be drawn from the upper portion of the hypolimnion for release. The conceptual design of the dams includes a multiple-level intake structure on the outlet works. If a preferred dam alternative is selected, the MPWMD shall conduct operation studies and detailed water temperature simulations to design the intake structure such that a high degree of flexibility is provided for water release from different levels of the water column.*

(b) *The dam outlet structure should be designed in such a way as to provide maximum reaeration of the released waters so that downstream waters are nearly saturated with dissolved oxygen.*

Implementation of these measures would reduce the operational impacts associated with each of the proposed reservoir alternatives to a less than significant level. In fact, the temperature analysis for steelhead in Chapter 8 indicates that there would be beneficial effects from some reservoir alternatives.

7.5.2 DESALINATION ALTERNATIVES

The effects of desalination facilities on marine water quality are addressed in Impact and Mitigation Measures 7.3.2-6 for the 3 MGD plant at Sand City and 7.3.4-6 for the 4 MGD plant at the MRWPCA treatment plant site.

7.5.3 NO PROJECT ALTERNATIVE

The No Project alternative would have no effect on water quality.

7.6 IMPACTS OF PROJECT CONSTRUCTION

7.6.1 RESERVOIR ALTERNATIVES

Impact 7.6.1-1

Construction of New Los Padres Dam could result in temporary adverse impacts to the water quality of the Carmel River.

The proposed New Los Padres Dam would involve construction in and immediately adjacent to the Carmel River channel. During construction, river flow would be diverted through the dam site in a large culvert. Construction activity would have no impact on streamflow or the downstream aquifers. However, water quality and sediment transport could be affected by construction activities.

Construction of the proposed dam would involve excavation and earth movement directly in and immediately adjacent to the Carmel River channel, resulting in direct and short-term impacts. A direct impact means that there is an immediate response to an action; short-term implies the duration of construction, or in this case for about two years. Because the Carmel River is used for water supply purposes, potential water quality impacts take on added significance.

The greatest water quality problem resulting from dam construction would be an increase in turbidity resulting from wastewater discharge or stormwater runoff from the construction site. Excavation for the dam foundation, aggregate processing and concrete batching all result in the generation of turbid or sediment-laden wastewater. If this wastewater were to be discharged directly to the Carmel River, a significant impact would result to downstream water users and aquatic life.

Other potential water pollutants, such as refuse, garbage, sewage, debris, oil and other petroleum products, mineral salts, industrial chemicals, etc., could lead to significant impacts to water quality if not properly disposed of.

As noted in Chapter 6, disturbance of soil and clearing of vegetation would result in a period of increased erosion. Excavation, earth moving and road building activities would expose bare soils to the erosive forces of wind and rain. Erosion potential would be greatest during the rainy months of November through March. Increased erosion would contribute sediment to the river that could damage downstream fish spawning habitat and increase municipal water treatment costs. If no precautions were taken, significant amounts of sediment could erode and be deposited in downstream areas. The mitigation measures presented below can only be stated in general terms because a detailed plan of construction has not yet been developed.

Mitigation Measures 7.6.1-1

(a) *Wastewater generated during construction should be recycled if possible, or it shall be treated prior to discharge to the Carmel River. At a minimum, the wastewater shall be treated by sedimentation to remove suspended particles from the water. Adequate freeboard would need to be provided in all sedimentation ponds to allow for proper functioning after an accumulation of sediment occurs, and ponds would need to be maintained regularly. Precipitating agents such as alum may be introduced to speed the action of settling suspended particles. Alternatively, either gravity or pressure filtration could be used if sufficient space for sedimentation facilities is unavailable.*

(b) *Runoff from nonpoint sources, such as the damsite, access roads and borrow areas, shall be controlled so as to avoid contributing sediment and turbidity to the Carmel River. Natural runoff should be routed around borrow areas and other disturbed areas. Roadways should be constructed with a minimum of steep cut and fill slopes. Turbid waters should be clarified using low permeable check dams to form settling ponds to allow the discharge of relatively clean water to the Carmel River. Erosion of disturbed materials from the borrow sites should be controlled by the implementation of reclamation activities such as regrading and revegetation immediately upon completion of construction. Topsoil should be stockpiled for use in revegetating disturbed areas. Lands within the inundation area should be used as borrow areas to the maximum extent feasible to reduce off-site impacts.*

(c) *A Spill Prevention Control/Countermeasure (SPCC) Plan shall be prepared by the contractor and fully implemented prior to the start of construction. The SPCC Plan would cover actions needed to minimize the potential for accidental spillage of construction-related contaminants such as fuel, oil or other chemicals. Waste oils, petroleum and other chemicals shall not be drained onto the soil; rather, such waste products shall be confined to sealed containers and removed to proper disposal sites.*

Refueling shall be conducted in a location where containment of spills could be accomplished.

(d) *Debris and refuse (such as cartons, containers, trash, etc.) shall be removed from the site and disposed of in an approved sanitary landfill.*

(e) *Chemical toilets shall be provided for the use of construction workers.*

(f) *It is recommended that brush and small timber be chipped into mulch and stockpiled for future use in the reseeding of the borrow areas.*

(g) *It is recommended that all areas that are to be protected should be staked or roped off.*

(h) *Excess fine material not used in the concrete mix should be distributed over flat areas outside the main natural drainage channels.*

These actions would be expected to reduce potential adverse impacts to a less than significant level.

Impact 7.6.1-2

Construction of the Cañada Dam project could result in temporary adverse impacts to the water quality of the Carmel River.

Construction of Cañada Dam would have effects on water quality similar to those described for the 24 NLP alternative under Impact 7.6.1-1 above, although because the amount of construction within the active channel of the Carmel River would be much less, limited to the construction of the diversion. Construction of the dam itself would not occur within the Carmel River channel, but rather would occur in an offstream canyon. However, the potential still exists for significant impacts to water quality resulting from erosion and spills of hazardous materials.

Mitigation Measure 7.6.1-2

Mitigation measures 7.6.1-1 for the 24 NLP alternative would be applicable to the 15 CAN alternative also.

These actions would reduce the potential water quality impacts to a less than significant level.

7.6.2 DESALINATION ALTERNATIVES

Impact 7.6.2-1

Construction of a desalination plant could have adverse effects on coastal water quality.

Grading and earthmoving activities, both at the proposed desalination plant site and along the pipeline routes, would expose disturbed soils to the erosive forces of wind and rain. This could in turn lead to sedimentation in nearby water bodies such as Monterey Bay. In addition, the accidental spill of fuel or other hazardous substances could adversely affect local water quality. While construction activities would be temporary in nature, the impacts to water quality could last beyond the duration of construction, depending on the extent of degradation. Thus, these potential impacts are considered to be significant.

Mitigation Measures 7.6.2-1

(a) *Prudent construction practices would be employed at all times, recognizing the sensitivity of the coastal environment.*

(b) *To the extent feasible, grading, excavation and other earthwork would be confined to the dry seasons. When this is not feasible, erosion and sediment transport control facilities would be put in place prior to the onset of the first major winter storms (see 7.6.2-1[c] below).*

(c) *A detailed Erosion and Sedimentation Control Plan would be prepared by the project engineer, and would be submitted for review and approval by the MPWMD and Monterey County Department of Public Works. The specific language of such plans varies, but the concepts to be adhered to include the following:*

- *Project runoff would be discharged into small drainages at frequent intervals to prevent build up of large, potentially erosive flows.*
- *To avoid discharge to natural waterways, sediment would be trapped before leaving the construction site through the use of rip-rap, hay bales, siltation fencing, or sediment ponds.*
- *Areas of surface disturbance would be minimized.*
- *Disturbed areas would be stabilized through vegetative or mechanical methods; when construction is complete, all disturbed areas would be regraded and revegetated.*

(d) *Runoff from nonpoint sources, such as the desalination plant sites and pipeline routes, would be controlled so that it would not contribute sediment and turbidity to local water bodies. Reclamation activities, such as regrading and revegetation, would be implemented as soon as construction is complete in order to control erosion of disturbed material along the pipeline routes. Topsoil should be stockpiled and used for the revegetation of disturbed areas.*

(e) *A Spill Prevention Control/Countermeasure (SPCC) Plan would be prepared by the contractor and would be fully implemented prior to the start of construction. The SPCC Plan would cover actions needed to minimize the potential for accidental spillage of construction-related contaminanis such as fuel, oil or other chemicals. Such contaminants would not be drained onto the soil; rather, they would be confined to sealed containers and removed to proper disposal sites. Refueling would be conducted in a location where spills could be contained.*

(f) *Debris and refuse would be removed from the site and disposed of in an approved sanitary landfill.*

(g) *Chemical toilets would be provided for the use of construction workers.*

Implementation of these mitigation measures would be expected to reduce the potential construction impacts to water quality to a less than significant level.

7.6.3 NO PROJECT ALTERNATIVE

The No Project alternative would have no construction-related impact to water quality; thus, no mitigation is necessary.

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8. FISH AND AQUATIC LIFE

8. FISH AND AQUATIC LIFE

8.1 SETTING

8.1.1 AQUATIC RESOURCES OF THE CARMEL RIVER

The Carmel River supports a generally low diversity of aquatic invertebrates. The local distribution and abundance of invertebrate populations is limited by the annual recession of streamflows, drying of the river (which usually extends approximately nine miles upstream) from the lagoon to the Narrows, by high flows, and the transport of coarse sand, which prevents organisms from colonizing lower portions of the river. A study of the benthic invertebrate fauna found six orders of aquatic insects, represented by 59 species, and eight non-insect orders, represented by 15 species. Of the non-insect species, the crayfish (*Pacifasticus leniusculus*), is the largest and most notable.[1]

The Carmel River contains a diverse, but limited, assemblage of amphibious and reptilian species, including the red-legged frog (*Rana aurora*), foothill yellow-legged frog (*Rana boylei*), California newt (*Triturus torosus*), Pacific treefrog (*Hyla regilla*), bullfrog (*Rana catesbeiana*), western toad (*Bufo boreas*), and western pond turtle (*Clemmys marmorata*). Chapter 9 outlines the status of amphibians and reptiles that are listed as threatened, endangered or of special concern, and describes the impacts of water supply projects on them.

8.1.2 EXISTING FISH RESOURCES

The Carmel River supports populations of steelhead (*Oncorhynchus mykiss*), Pacific lamprey (*Entosphenus tridentatus*), river lamprey (*Lampetra ayresi*), coast range sculpin (*Cottus aleuticus*), prickly sculpin (*Cottus asper*), Sacramento hitch (*Lavinia exilicauda*), threespine stickleback (*Gasterosteus aculeatus*), Sacramento blackfish (*Orthodon microlepidotus*), starry flounder (*Platichthys stellatus*), shiner perch (*Cymatogaster aggregata*), Pacific staghorn sculpin (*Leptocottus armatus*) (in the lagoon), brown trout (*Salmo trutta*), goldfish (*Carassius auratus*), green sunfish (*Lepomis

cyanellus), bluegill (*Lepomis macrochirus*), mosquitofish (*Gambusia affinis*), and carp (*Cyprinus carpio*).

Of these fishes, the steelhead is considered the most important sport fish, and extensive investigations have been undertaken to define its ecology in the river. The Carmel River supported what the California Department of Fish and Game (CDFG) described as the state's largest self-sustaining steelhead resource and the second largest fishery for this species south of San Francisco.[2]

California state law stipulates that healthy steelhead populations shall be protected or restored by controlling the harvest of adults, providing suitable spawning grounds, and maintaining rearing habitat for juvenile steelhead. Unfortunately, the development of water resources within the basin, the current drought, and other environmental problems threaten the Carmel River population. The CDFG has expressed concern that the steelhead population in the Carmel River is threatened with becoming a remnant run.[3] CDFG's policy and goal for managing the steelhead resource is to "maintain it as a self-sustaining resource and to restore it as much as possible to its historic level of productivity." To accomplish this goal, environmental problems that limit habitat and reduce opportunities for adult migration and juvenile emigration will have to be corrected. The correction of these problems will probably benefit other indigenous fish populations as well.

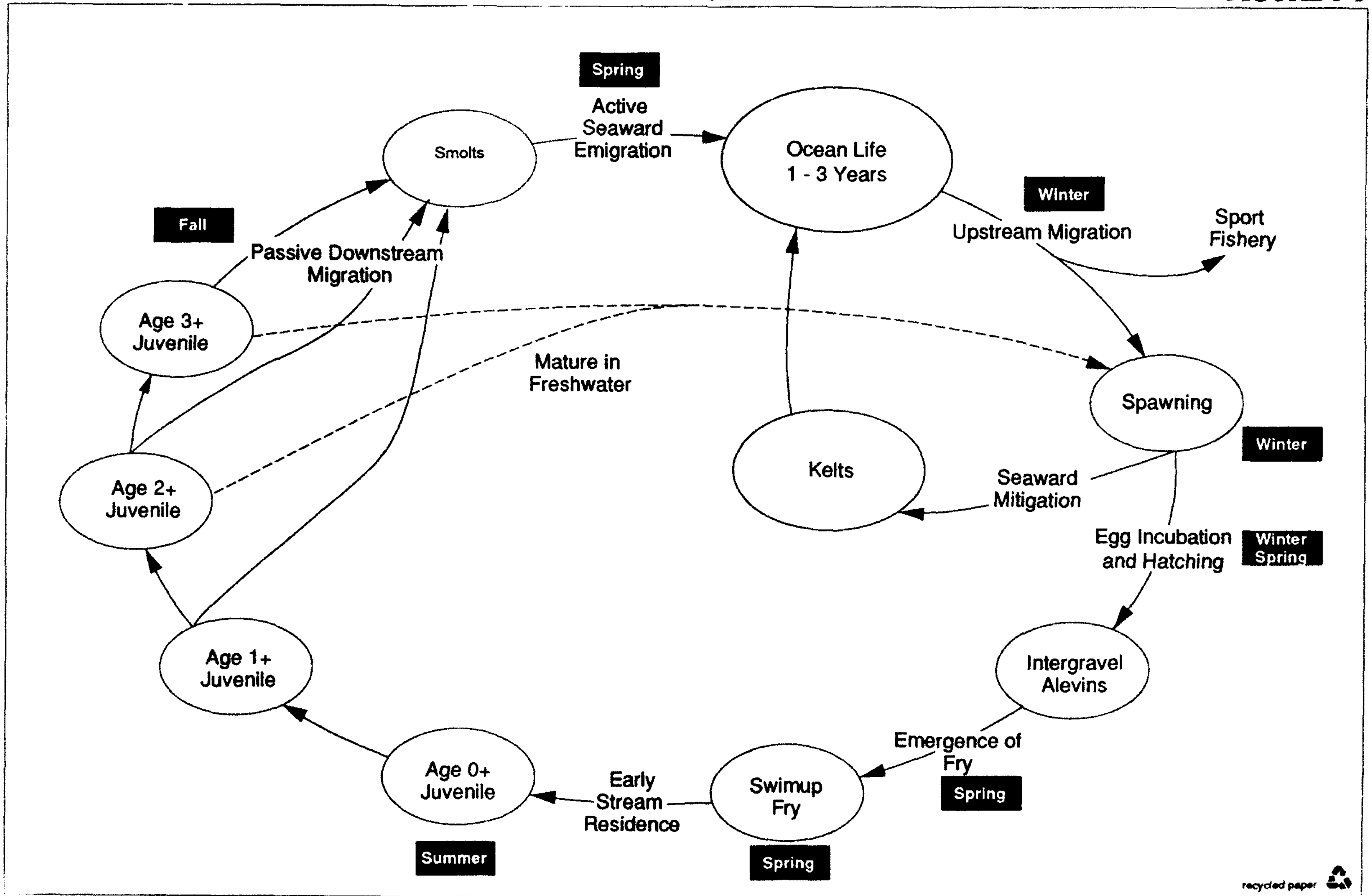
8.1.3 STEELHEAD LIFE CYCLE

Adult steelhead live in the ocean and migrate into the Carmel River to spawn (Figure 8-1). As indicated by adult counts at San Clemente Dam, the migration of adults historically started with the beginning of major storms in the late fall or early winter and continued through March and, in some years, April. Following upstream migration, the female steelhead establish territories, dig nests in the bottom of the stream, and deposit eggs that are then fertilized by one or more males. In the Carmel River adults have been observed spawning from February through March, but they probably spawn from as early as mid-January to as late as early April.[4]

Eggs buried in nests incubate three to eight weeks, depending on water temperature, and hatch in late winter or early spring. The newly hatched fry reside in the gravel up to two weeks, emerge from the nest, and the swim-up fry disperse into quiet areas along the stream margin, where they begin to feed.

LIFE CYCLE OF STEELHEAD IN THE CARMEL RIVER BASIN

FIGURE 8-1



SOURCE: MPWMD

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Steelhead fry grow rapidly during the spring and soon move into swifter, deeper water in riffles, runs and the upstream and downstream ends of pools. Throughout the late spring, summer and fall the juveniles feed on immature aquatic insects or on terrestrial insects that fall into the river.

Beginning with the first rains of the fall, some juveniles move downstream. During the following spring many juveniles change into smolts (juvenile steelhead that have adapted to seawater) and emigrate into the ocean. Other juveniles remain in freshwater for one to two more years before they enter the ocean.

Steelhead from the Carmel River spend one to four years in the ocean before returning to spawn. Unlike other Pacific salmon, not all steelhead die after spawning. Many migrate back downstream as "kelts" and reenter the ocean. Some of the larger and older adults who reentered the ocean as kelts and migrated upstream again are called "repeat spawners." Occasionally, juvenile steelhead mature in fresh water and spawn without migrating to the ocean. This occurs most frequently during droughts when juveniles are trapped in the river and cannot emigrate to the ocean.

8.1.4 SPAWNING AND REARING HABITAT

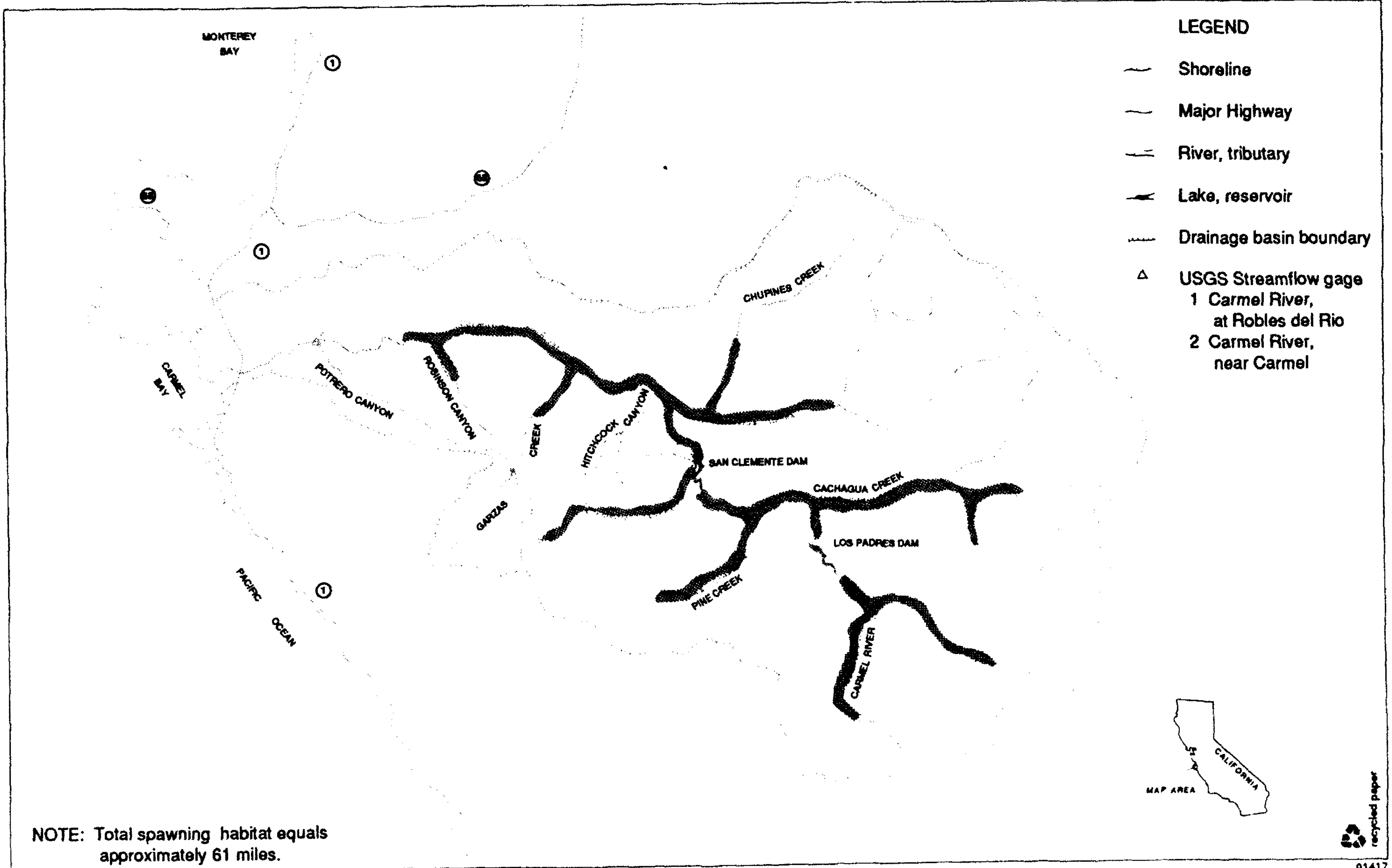
Figure 8-2 illustrates the extent of upstream adult migration in the Carmel River Basin. In most years, adult steelhead spawn in a total of 60.5 miles of stream habitat, including 24.5 miles of the mainstem, 30 miles of primary tributaries, and 6 miles of secondary tributaries.

Spawning habitat in the mainstem upstream of the Narrows totals 120,000 square feet, including 50,000 square feet in the reach from the Narrows to San Clemente Dam (41 percent of total), 10,000 square feet from San Clemente Reservoir to Los Padres Dam (9 percent of total) and 60,000 square feet upstream of Los Padres Reservoir (50 percent of total). Spawning habitat in the mainstem below San Clemente Dam and between San Clemente Reservoir and Los Padres Dam is limited by the entrapment of spawning gravels in the existing reservoirs.

Figure 8-3 illustrates the extent of juvenile rearing habitat in the Carmel River Basin. In most years, 49 miles of rearing habitat are available, including 20 miles of the mainstem, 24 miles of primary tributaries, and 5 miles of secondary tributaries.

STEELHEAD SPAWNING HABITAT IN
THE CARMEL RIVER BASIN

FIGURE 8-2



NOTE: Total spawning habitat equals approximately 61 miles.

SOURCE: MPWMD

MILES 0 2 4

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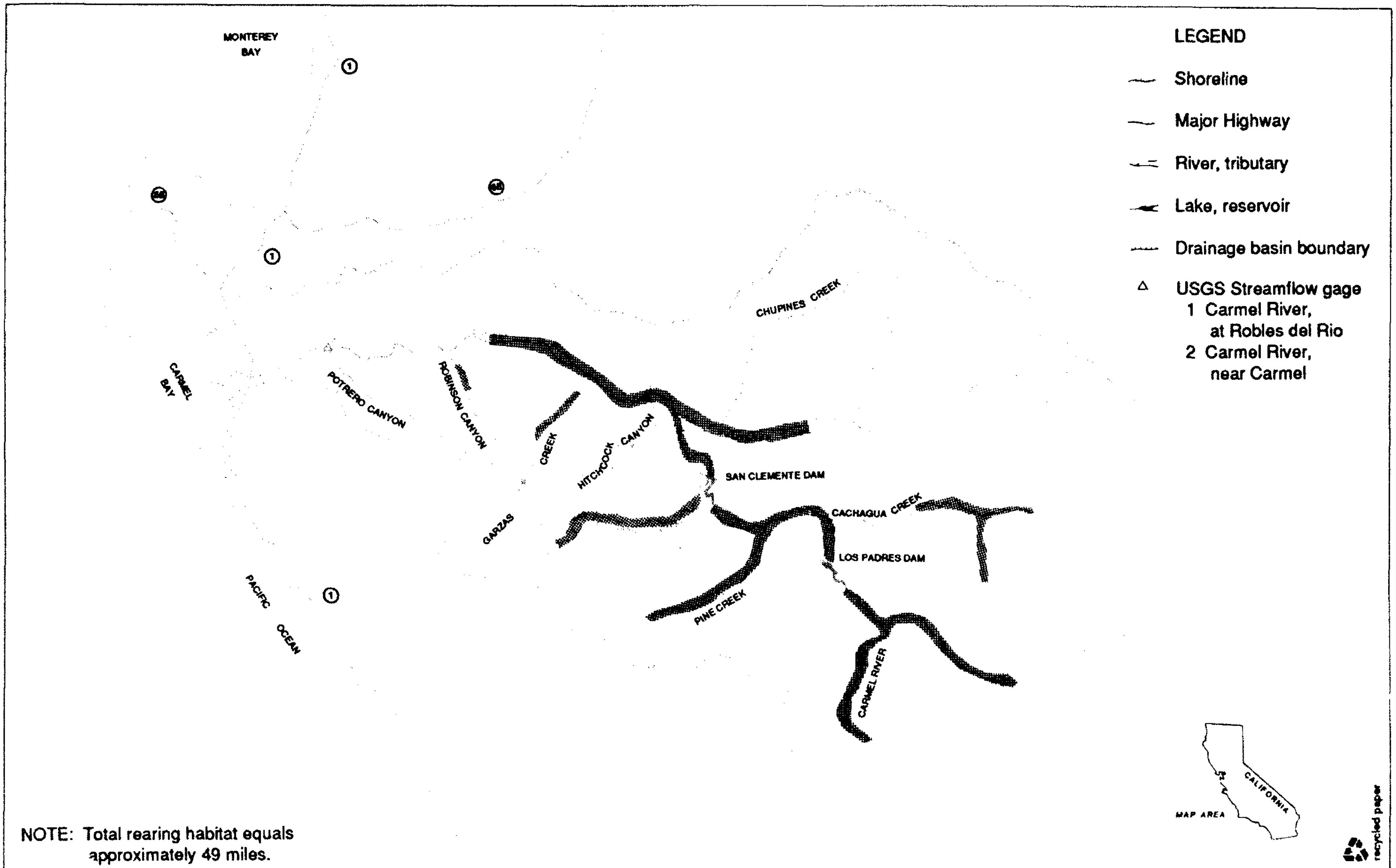
STEELHEAD REARING HABITAT IN THE CARMEL RIVER BASIN

FIGURE 8-3



NOTE: Total rearing habitat equals approximately 49 miles.

SOURCE: MPWMD

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The rearing habitat in the mainstem of the Carmel River can be divided into three reaches based on the physical character of the channel and summer flow regimes:

> Upper Mainstem – Most rearing habitat upstream of Los Padres Dam is within the Ventana Wilderness Area, where river flow is unregulated, roads have not caused erosion, the gradient is steep (320 ft/mile), and bedrock outcrops control the course of the channel. Deep pools, separated by short, shallow glides and long, cobble/boulder riffles and runs, are common.
>
> Middle Mainstem – The configuration of the reach between the dams is controlled by bedrock outcrops and large boulders. The substrate is a mixture of cobbles and boulders. During summer, water stored in Los Padres Dam is released into the channel and diverted or released at San Clemente Dam. By agreement with CDFG, Cal-Am maintains a 5 cfs minimum flow below Los Padres Dam. Due to variation in natural accretion, the augmented dry season flows range from 5 cfs in critical years to 15 cfs in wet years.
>
> Lower Mainstem – Below San Clemente Dam the river is controlled primarily by bedrock outcrops downstream to near Paso Hondo Road (Powell's Hole). Another factor is the interaction of alluvial deposits with storm flows that periodically rearrange, scour, and deposit bedload along the coarse of the river. Beginning in 1984 the District, CDFG, and Cal-Am negotiated an agreement to release water during the low-flow season. Releases have varied from 2.5 to 5 cfs during the period between 1984 and 1990, and have improved aquatic habitat in the reach between the Narrows and San Clemente Dam.

Based on the Rearing Index for age 0+ steelhead, 28 percent of the total rearing habitat occurs in the reach from the Narrows to San Clemente Dam, 33 percent occurs from San Clemente Reservoir to Los Padres Dam, and 39 percent occurs upstream of Los Padres Reservoir. For yearling steelhead, 23 percent of the total rearing habitat occurs in the reach from the Narrows to San Clemente Dam, 20 percent occurs from San Clemente Reservoir to Los Padres Dam, and 57 percent occurs upstream of Los Padres Reservoir. Basinwide, rearing habitat totals 12.9 million units for age 0+ steelhead and 5.9 million units for yearling steelhead. Rearing habitat units relate to the square feet and quality of habitat. These totals do not include habitat in Pine Creek, Robinson Canyon, Garzas Creek, or Hitchcock Canyon.

8.1.5 EXISTING FISH PASSAGE FACILITIES

Maintenance of a large, healthy steelhead population in the Carmel Basin depends on the survival rates of adult steelhead and juvenile steelhead during their annual migrations. As indexed by counts at San Clemente and Los Padres Dams, most adults migrate upstream during January, February and March, but in some years, when seasonal flows are early or late, adults migrate upstream during December or April.

As indexed by counts of juvenile steelhead in the lower Carmel River and in nearby Waddell Creek, juveniles migrate downstream during all months.[5,6] However, the bulk of juveniles migrate downstream in three distinct groups, including age 0+ fingerlings displaced during late spring and early summer (May through July); large age 1+, 2+, and 3+ juveniles that passively migrate downstream during late fall and early winter; and smolts that actively emigrate downstream during late winter and spring (March through May).

Existing passage facilities include a steep, pool and weir ladder at San Clemente Dam, and a short ladder and trap at Los Padres Dam. The District, as part of the Allocation Mitigation Program, will construct and operate three passage facilities to mitigate existing impacts of diversions on migrating steelhead: 1) a portable seasonal trapping facility downstream of the Narrows; 2) a holding facility near Schulte Road; and 3) a portable acclimation facility in Carmel River Lagoon.

8.1.5.1 Facilities at San Clemente Dam

Fish Ladder. Cal-Am owns and operates an 85-foot-high ladder at San Clemente Dam. Although not well-documented, the ladder appears to provide adequate passage for adults migrating upstream and juveniles migrating downstream. This opinion is based on the counts of adult steelhead which were made during the period 1962-1975 and in 1984, on observations of fish climbing the ladder, and on the fact that the ladder was operating for about 30 years with no evidence of a declining steelhead run. However, several problems have been identified: The drops between some pools do not meet current design standards; there are no attraction flows provided at the base of the ladder; and down-cutting of the river below the dam has reduced the water surface elevation in the afterbay.

Spillway Gates. Although not specifically part of fish passage facilities, the operation of spillway gates at San Clemente dam may impact adults and juveniles emigrating downstream to the ocean during spring months by subjecting them to injury when they spill over the top of spillway gates, or to delay in passing downstream because of difficulty in finding the gated orifice which leads to the fish ladder.

8.1.5.2 Facilities at Los Padres Dam

Fish Ladder. Cal-Am owns and operates a 50-foot-long Denil ladder and fish trap at the base of Los Padres Dam. Adults are dip-netted, placed into a tank and trucked upstream to the reservoir. In 1982 a fish "gabion" barrier was placed just upstream from the ladder entrance to prevent adults from

passing into the plunge pool below the spillway. The existing facilities may stress adults by crowding in the small holding pool, by netting, and by crowding and high temperatures during transport.

Spillway. No specific facilities were built at Los Padres Dam to pass juvenile and "kelt" (adults that have completed spawning) steelhead downstream through the reservoir or over the dam. Under existing conditions, emigrating juveniles and kelts can pass through the reservoir and down the spillway chute whenever the reservoir spills. In 1986 passage conditions were improved by installing an 8-inch-high concrete sill in the lower section of the spillway and a metal extension on the end of the spillway, and by removing a large boulder in the plunge pool at the base of the spillway.

Conditions in the spillway or below it injure and harm emigrating juvenile steelhead, probably as the fish drop onto a bedrock outcrop below the spillway. At high flows fish may be injured when they are subjected to high velocities and rough concrete in the spillway.

During spring 1992 District staff measured the direct mortality in the spillway at flows ranging from 50 to 40 cfs. Mortality was assessed by making releases of marked fish at the top and bottom of the spillway and recapturing the survivors of each group in a trap located 300 feet below the spillway. These experiments indicated mortality averaged 20 percent and ranged from zero to 52 percent. If the average mortality of 20 percent in 600 feet (0.03 percent per foot) was representative of natural conditions, then all smolts in the river would be lost after migrating only 3,300 feet downstream. Considering the total distance from the reservoir to the ocean is 24.5 miles, or 168,000 feet, a mortality of 20 percent over 600 feet of channel is excessive.

8.1.5.3 Seasonal Trapping Facility

As part of the Water Allocation Program Mitigation Program, the District will operate a portable trap. It is designed for years when March, April and May flows are too low for successful smolt emigration, or when the first rains of the year stimulate juvenile steelhead to migrate into the reach below the Narrows, where subsequent post-storm flows isolate and strand the fish.

The conceptual design includes a series of portable V-shaped racks and fish screens placed across the stream to catch leaves and small debris and to guide migrants into partially submerged trap(s) located along the bank of the stream. The District and Carmel River Steelhead Association have operated

similar, but smaller, traps for two years with good success. The facility will be designed to operate at flows of up to about 90 cfs.

8.1.5.4 Holding Facility Near Schulte Road

Trapped steelhead should not be held longer than overnight because they are stressed by sunlight and confinement. For this reason, the existing mitigation program includes a facility to temporarily hold juveniles before they are transported downstream to the lagoon or ocean. In cooperation with Cal-Am, the District will modify a pond at the old Cal-Am treatment plant near Schulte Road. A channel will be constructed within the pool to include a series of weirs and pools. The channel will be provided with an overflow to allow fish to naturally emigrate if flow conditions improve in the river. A streamside galley and pump with a capacity of 2 cfs would be constructed to divert surface flows for the facility.

8.1.5.5 Acclimation Facility at Carmel River Lagoon

Smolts held in the facility near Schulte Road will be transported to the Carmel River Lagoon and held for a short time prior to their release into the ocean. This allows time for acclimation to saltwater and for staff to release them during nighttime hours. The facility will consist of a portable net pen, identical to those used throughout in the Pacific Northwest for holding juvenile salmon in lagoons and bays.

8.1.6 STATUS OF THE STEELHEAD RESOURCE IN THE CARMEL RIVER

The existing steelhead run is primarily supported by habitat in the Carmel River and tributaries upstream of Robles del Rio where permanent, year-round streamflows and substrate conditions are suitable for juveniles throughout the summer. Some adults spawn in the Carmel River below Robles del Rio, but in many years the progeny have died when the river below Robles del Rio has dried up during the summer.

The most recent estimate of the total steelhead run in the Carmel River was 860 adults during 1984.[7] Of the total, an estimated 480 fish, or 56 percent of the run, were harvested in the lower river, and about 380 fish migrated past San Clemente Dam. During 1984 only 51 adults were trapped at the base of Los Padres Dam and transported upstream, and an unknown, but probably small, number of adults spawned in the river downstream of San Clemente Dam. Previous estimates of the run at San

Clemente Dam were 395 fish in 1974 and 1,287 fish in 1975.[2] Kelley, Dettman and Reuter calculated that the Carmel River could support a total run of about 3,500 adults upstream of San Clemente Dam.[8] A comparison of this estimate to the run of 860 fish in 1984 indicates the river produced only 25 percent of its full potential in that year. CDFG biologist William Snider[2] concluded on the basis of his analysis that the run had declined by the same percentage, but that the potential of the basin to produce steelhead was about twice the number estimated by Kelley, Dettman, and Reuter. Regardless of the absolute number of adults that can be supported in the river, there is general agreement that the run has declined during the last 20 years.

Impact of the 1987-92 Drought

The 1987-1992 drought, combined with diversions totaling more than the inflow, eliminated natural opportunities for upstream migration of adults and downstream emigration of juveniles during the past four years. Limited opportunities for upstream migration were available in 1987 and 1991, and no outflow through the rivermouth occurred in 1988, 1989 and 1990. Thus, sea-run adults were unable to migrate upstream from the ocean to spawn during those years. However, some adults from the 1987 sea-run of adults were landlocked and spawned during spring 1988 and 1989.

The lack of sea-run adults during the period 1988 through 1991, and critically low flows during spring months combined to reduce the population of emigrating smolts to remnant levels. During late winter and spring of 1989, 1990 and 1991, the Carmel River Steelhead Association (CRSA) and the MPWMD operated smolt migration traps and captured emigrating smolts in the river below the Narrows. During spring 1989, a total of approximately 200 smolt-sized juveniles were trapped or captured in the lower river. During spring 1990, a total of 162 smolts were captured, with most of the population emigrating during March. During Spring 1991, District staff rescued or trapped a total of 700 smolt-sized steelhead. Annual production of only 150-700 smolt-sized fish during 1989, 1990 and 1991 is the result of insufficient numbers of adult sea-run fish spawning in the river during 1987, 1988, 1989 and 1990.

To mitigate for the impacts of exporting water from the Carmel Basin, MPWMD and Cal-Am signed an Interim Relief Plan and Agreement. The agreement specified several programs, including the transport of smolts in critically dry years and the rescue of stranded juveniles during normal years, as mitigations to lessen impacts on the steelhead population. The programs were implemented in Fall 1989, but were not designed to cope with three or more years of dry or critically dry conditions.

Because of the severity of the 1987-1992 drought, the steelhead run will be reduced to remnant levels for several years.

8.1.7 FACTORS ASSOCIATED WITH THE DECLINE OF STEELHEAD

Past reviews of environmental problems in the Carmel River have led to an understanding of the principal factors that constrain the steelhead population in the Carmel River.[9] These include:

1) Inadequate passage facilities for adults and juveniles at Los Padres Dam – fish may be injured when passing over the dam at low flows.

2) Diversion of surface flows at San Clemente Dam – rearing habitat for young-of-the-year and yearlings is significantly reduced when river flow is reduced below San Clemente Dam due to diversions.

3) Subsurface diversion of streamflows which percolate into the Carmel River Aquifer between San Clemente Dam and the Lagoon – declines in spring flows reduce habitat for juveniles, impair smolt emigration and threaten emigrating fish by stranding them in drying pools.

4) Reduction in the number of trees and canopy of the riparian forest downstream of Robles del Rio – reduces food available for juvenile steelhead, increases water temperatures, and reduces the quantity and quality of steelhead habitat.

5) Increased erosion of sand and gravel from denuded riverbanks by winter flows – destroys steelhead habitat by filling in spaces between cobbles and boulders needed by juvenile fish and the aquatic insects they feed on.

6) The interruption of streamflow at San Clemente Dam and blockage of smolt emigration – raising the spillway gates in Spring may impair steelhead emigration while the reservoir is filling, and reduces streamflow downstream of the dam. This may result in temporary or seasonally complete blockage of smolt migration past San Clemente Dam in some years.

7) Deposition of sand and reduced freshwater inflow into the Lagoon – reduces habitat for adults during the winter, for smolts during the spring, and for juveniles during the summer and fall months. These factors may result in high water temperatures, low dissolved oxygen levels, high salinities, shallow water depths, and high levels of bird predation.

8) Insufficient flows for upstream migration of adults during droughts – due to the extraction of groundwater during summer months, the aquifer does not fill, or fills later during the following wet season. This delays or eliminates flows needed for upstream migration in January, February and March.

Each of these factors and the ways in which they reduce the steelhead population are discussed in detail in MPWMD Planning Memorandum 91-01, which is hereby incorporated by reference.[10]

8.1.8 EXISTING MITIGATION PROGRAMS

The Water Allocation Program Final EIR (1990) described how existing water supply practices, despite the efforts outlined in Chapter 2, result in significant adverse impacts to the steelhead resource and other elements of the Carmel River environment.[11] As a result, the District adopted a comprehensive five-year mitigation program in November 1990 that will be reviewed in 1995 (or earlier). The program entails the following four mitigations, which incorporate and supersede the Interim Relief efforts noted in Section 8.1.6:

- Expand program to capture emigrating smolts in spring.
- Prevent stranding of fall/winter juvenile migrants.
- Rescue juveniles downstream of Robles del Rio in summer.
- Experimental smolt transport program at Los Padres Dam.

The estimated capital cost of the fisheries mitigation program is $407,700. Average annual O&M costs for the each of the five years are estimated at $212,900 per year. These costs could range as high as $382,200 in dry years. The comprehensive Water Allocation Program mitigation plan is provided in Appendix 2-C.

8.2 HABITAT NEEDS, CRITERIA AND STANDARDS OF SIGNIFICANCE

Maintenance of a large, vigorous steelhead population in the Carmel River depends on sufficient spawning and rearing habitat; flows for the upstream migration and spawning of adults, the successful incubation of eggs, the rearing of juveniles, emigration of smolts from fresh water into the ocean; and the passage of adults upstream and juveniles downstream over San Clemente and Los Padres Dams.

By the nature of the designs and operations specified in Chapter 4, all of the water supply alternatives analyzed in this EIR/EIS may affect habitat and/or streamflows in the Carmel River. Some alternatives would inundate or block spawning and rearing habitat. Some may result in continued direct or subsurface diversion of streamflow from the river that can interfere with or block the steelhead life cycle. Conversely, other alternatives would augment streamflow and result in beneficial impacts to steelhead habitat.

Sections 8.2.1 and 8.2.2 summarize the criteria used to compare impacts due to inundation and blockage of habitat. Sections 8.2.3 through 8.2.7 summarize how the criteria used to compare impacts of project operations (and the effect on streamflow) were developed. Referring to Figure 8-1, streamflow in the Carmel River affects five portions of the life cycle: upstream migration of adults, spawning of adults, rearing of juveniles, downstream migration of juveniles during the late fall and winter, and seaward emigration of smolts during the spring. Section 8.2.8 summarizes criteria used for the effects of alternatives on fish passage, while Section 8.2.9 summarizes criteria used to assess the impacts on temperature. Section 8.2.10 summarizes how the District will develop an index of the overall health of the steelhead resource, represented by the number of returning adult steelhead to the Carmel River. The fate of each year class for numerous generations would be tracked over a simulated period of at least three decades. The results will be prepared in the form of a technical report for the interagency Fishery Working Group, which will be summarized in the Final EIR/EIS.

8.2.1 INUNDATION AND BLOCKAGE OF SPAWNING HABITAT

MPWMD Technical Memorandum 89-03, which is hereby incorporated by reference, describes the methods for determining the amount of spawning habitat that would be inundated or blocked by each alternative.[12] Briefly, the amount was determined by measuring the linear extent of inundation or blockage and multiplying this extent by the square feet of spawning habitat per foot of stream. The square footage was based on field measurements of spawning habitat in the reaches that would be inundated or blocked.

Standards of Significance

For the purposes of this EIR/EIS, a loss of only one percent of existing spawning habitat is considered significant. Spawning habitat is considered a critical habitat component by resource agencies. U.S. Fish and Wildlife Service (USFWS) staff noted that even though losses with some tributary reservoirs are small compared to the total habitat available in the basin (120,000 square feet), the losses in terms of percentages for tributaries as separate units are major. For this reason, a significant adverse impact is defined as a one percent loss of spawning habitat.

8.2.2 INUNDATION AND BLOCKAGE OF REARING HABITAT

MPWMD Technical Memorandum 90-03, which is hereby incorporated by reference, describes the methods used to determine the quantity and quality of rearing habitat inundated or blocked by each alternative.[13] Briefly, the linear extent of inundation or blockage was measured and multiplied by the square feet of rearing habitat per foot of stream. In addition, the linear extent was multiplied by a habitat index per foot of stream. This index corrects for the bias produced by simply comparing the square footage of habitat in smaller streams to the footage in larger streams. Usually, the quality per square foot in a larger stream is greater than in smaller streams. The square footage and quality ratings were based on field measurements in the reaches inundated or blocked.

For the purposes of this EIR/EIS, a significant adverse impact is defined as a one percent loss of juvenile rearing habitat, similar to the spawning habitat standard noted above.

8.2.3 FLOWS FOR ADULT UPSTREAM MIGRATION

The flows needed for upstream migration of adult steelhead have been studied extensively, and are discussed in MPWMD Technical Memorandum 89-05 and several reports (hereby incorporated by reference).[14] There are three basic elements: pulses of high flows to attract adults into the river in winter (January, February and March); adequate river flows to transport adults upstream to spawning sites; and adequate outflows to keep the river mouth open between storms.

A key element in determining adequate transportation flows is the role of "critical riffles" -- areas of the river bottom that may act as barriers for migrating fish. CDFG staff had recommended a minimum transportation flow of 40 cfs at Highway One during January, February, and March. District staff believed that a 75 cfs minimum would be needed for fish to pass over critical riffles in the lower Ca .el River. During the period from March thru early May, 1991 the District measured conditions at five critical riffles in the reach below Schulte Road. The interagency Fishery Working Group reviewed the results of these measurements and reached a verbal consensus that a minimum flow of 60 cfs is needed with existing substrate conditions.

The impact of flow patterns resulting from project operations on upstream migration was assessed seasonally, monthly and daily. The data used were daily or monthly Carmel Valley Simulation Model

(CVSIM) output for each alternative. The 90-year simulated record from water years (WY) 1902-1991 was used; more detailed analyses focused on the 34-year record from WY 1958-1991.

Standards of Significance for Upstream Migration

Throughout this chapter, all assessments of project operations compare the simulated flow regime resulting from each alternative with the simulated flow regime for unimpaired conditions (i.e., absence of manmade facilities or water demand). The less technical term "natural conditions" is used instead of "simulated unimpaired conditions" throughout the chapter.

Ratings of Seasonal Flows: The District has applied modified CDFG's recommendations for flows at Highway One for upstream migration. CDFG's original recommendations (listed in Table 8-1) were modified by increasing the minimum flow at Highway 1 from 40 to 60 cfs, and by adopting a sliding scale of attraction flows for dry and critical years, when adults are attracted by flows lower than 200 cfs under natural conditions.[15] These modifications result in a seasonal total of 15,800 AF during the period January 1 through March 31 of below normal or better years, and a total of 13,000 AF during dry and critically dry years. To rate seasonal migration opportunities with each alternative, the seasonal criteria were compared to simulated seasonal runoff into the Lagoon during the period from 1902 to 1991.

An impact was considered significant if more than 18 percent of the simulated years failed to meet the seasonal flow criteria, or if two or more consecutive years with insufficient flows would occur. The 18 percent standard corresponds to the percentage of years when flows in "natural" (simulated unimpaired) conditions would not meet the criteria. Two or more consecutive years with insufficient seasonal flows would reduce the seeding of rearing habitat to levels associated with a remnant run of steelhead.

Ratings of Mean Monthly Flows: The MPWMD has determined that flows of 4,500 AF in January and March and 4,200 AF in February are necessary to produce at least "fair" conditions for upstream migration.[16] With the adoption of a sliding scale of requirements, these criteria can be reduced to 3,400 AF in February and 3,500 AF in March of dry and critically dry years. The simulated average monthly flows at the lagoon for each alternative were compared to these monthly criteria for the period 1958 to 1991. An impact was considered significant if flows during 34 percent of the Januaries, 19 percent of the Februaries, or 18 percent of the Marches failed to meet "fair" migration

TABLE 8-1

MINIMUM FISH FLOWS REQUIRED BELOW SAN CLEMENTE DAM AND PAST HIGHWAY 1 VERSUS AVERAGE OUTFLOW FROM THE CARMEL RIVER (1940-1982), MEASURED NEAR CARMEL

Fish Flow Period	Purpose of Flow	Duration (Days)	Minimum Flow at Dam[1] (cfs/acre-ft)	Minimum Flow at Highway 1 (cfs/acre-ft)	Runoff Average Near Carmel[2] (acre-ft)	Runoff net at Hwy 1[3] (acre-ft)
Jan-Mar	Attraction	18	200/ 7,200	200/ 7,200	–	–
	Spawning, Incubation, Migration	72	75/ 10,800	40/ 5,800	–	–
	TOTAL	90	–/ 18,000	–/13,000	35,700	25,700
Apr-May	Incubation, Migration, Rearing	61	40/ 4,880	20/ 2,440	7,400	4,760
Jun-Dec	Rearing	214	20/ 8,600	5/ 2,200	4,500	2,300
TOTAL			31,488	17,640	47,600	28,860

1 Kelley (1982).
2 Average outflow from system after diversions (1940-82).
3 Average runoff available at downstream diversion point addition to existing diversions.

Source: California Department of Fish and Game.

conditions. The percentages were selected because they reflect how often "fair" migration conditions would be met under simulated natural conditions.

Ratings of Daily Flows: The minimum daily flows recommended by CDFG and Kelley for attracting steelhead were used to compare project impacts on a daily basis.[17] The basic CDFG recommendation of 200 cfs for attracting adults was used in below normal and better years. D.W. Kelley and Associates' recommendation of using attraction flows of 100 cfs in February and 75 cfs March was applied in dry and critical years.

Based on a review of the relationships between water depth and streamflow over existing critical riffles, the FWG agreed that a minimum transportation flow of 60 cfs is needed in the reach below Schulte Road. This criteria was applied to January, February, and March of all year types.

To rate opportunities for upstream migration, duration of the migration season and the number of days with attraction flows were tallied for each alternative during the period from 1958 to 1991. An impact was considered significant if the duration of the migration season (stratified by year type) and the number of attraction days was reduced from levels that would have occurred under natural conditions, or if the percentage of years without attraction flows of 200 cfs exceeded 12 percent (which corresponds to performance under natural conditions).

8.2.4 FLOWS FOR SPAWNING ADULTS

The quality and quantity of spawning habitat is controlled primarily by streamflow, which creates an appropriate mosaic of suitable depths and velocities over the streambed. Another factor is the abundance and distribution of gravel and small cobbles, which must be small enough for the adult female to move, but large enough to resist scouring flows after the nest is constructed.

The impact of water supply operations on steelhead spawning habitat was examined in two reaches of the mainstem of the Carmel River: the 9.0-mile reach from the Narrows to San Clemente Dam and the 5.4-mile reach from San Clemente Reservoir to Los Padres Dam (Figure 7-1).

Standards of Significance for Spawning Adults

Downstream of San Clemente Dam: The relationship between steelhead spawning habitat and flow downstream of San Clemente Dam has been studied by the USFWS in 1980 and the District in 1982.[18] The results of these studies indicated that no spawning habitat would be available at flows less than 40 cfs and that the amount of spawning habitat increased rapidly in direct proportion to flows up to about 150 cfs. In 1992, the District hired D. W. Alley and Associates to apply the USFWS Instream Flow Incremental Methodology (IFIM) to spawning habitat in the reach between the Narrows and San Clemente Dam. Based on this most recent study, the relationship in Figure 8-4 was applied to simulated mean monthly flows at the Narrows. A significant impact is defined as more than a one percent reduction in average spawning habitat from that which would occur under simulated natural conditions. The one percent reduction is equivalent to about 80 units of weighted usable spawning area.

Between San Clemente Reservoir and Los Padres Dam: The relationship between spawning habitat and flow in this reach was developed based on the USFWS habitat model (IFIM) for steelhead spawning habitat.[19] The relationship in Figure 8-5 was applied to simulated monthly streamflow below Los Padres Dam. A significant impact is defined as a one percent reduction as compared to natural flow conditions. This is equivalent to about 30 units of weighted useable spawning habitat.

8.2.5 FLOWS FOR REARING JUVENILES

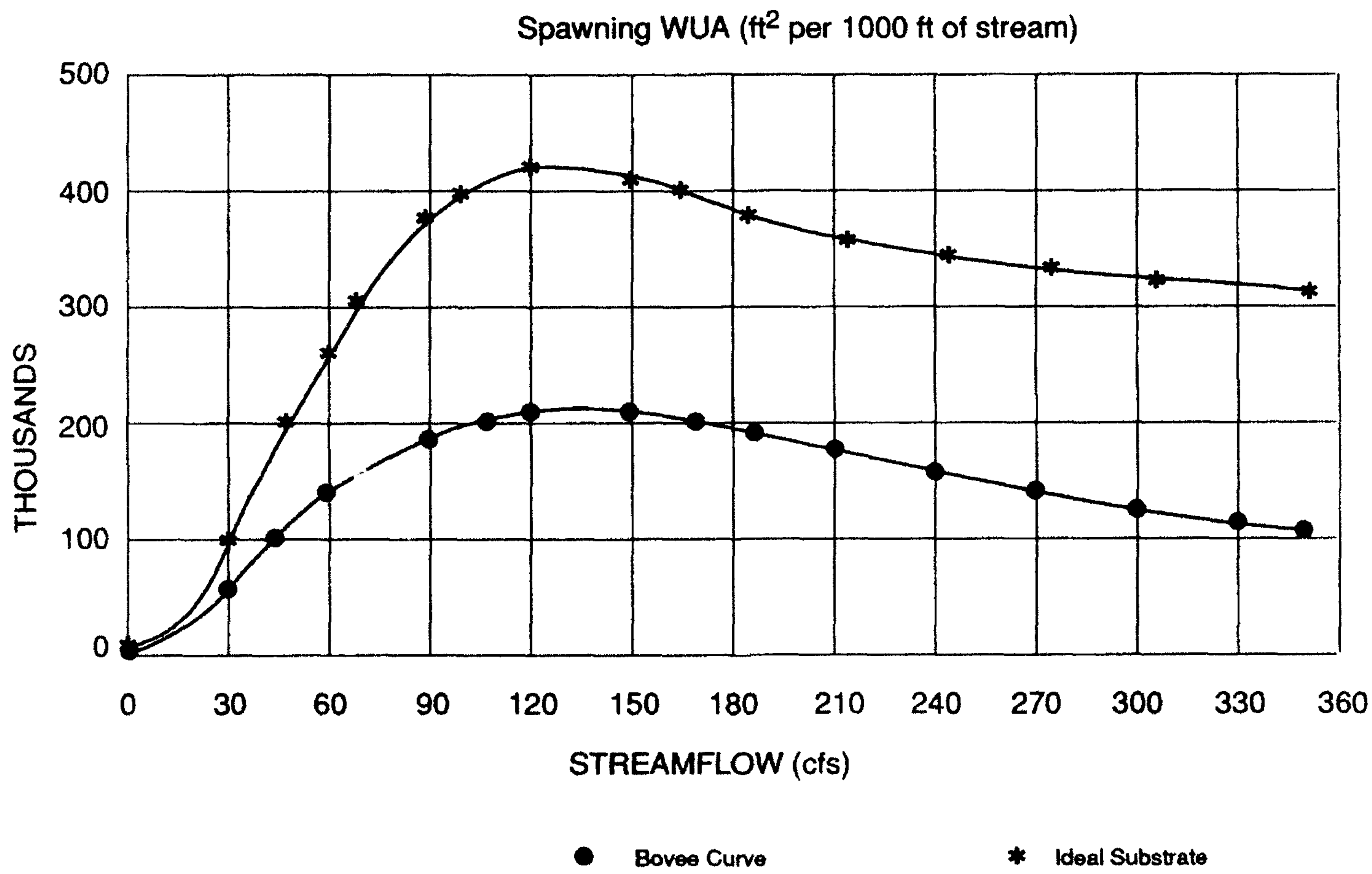
The quality and quantity of rearing habitat for juvenile steelhead is directly influenced by streamflow. The results of several studies indicate summer habitat is a crucial factor that limits the juvenile steelhead population.[20] The impact of water supply project operations on juvenile rearing habitat was examined in three reaches of the Carmel River: the 8.6-mile reach from Highway One to the Narrows, the 9.0-mile reach from the Narrows to San Clemente Dam, and the 5.4-mile reach from San Clemente Reservoir to Los Padres Dam.

Standards of Significance for Rearing Juveniles

Downstream of the Narrows: Streamflow downstream of the Narrows usually recedes rapidly during late spring due to reduced inflow from the upper watershed, the closure of gates at San Clemente Dam and the increase in groundwater pumping in the lower Carmel Valley. By mid- to late-summer, streamflow usually ceases at the USGS Near Carmel gage. Juvenile habitat in the lower river is

RELATIONSHIP BETWEEN COMPOSITE WEIGHTED USABLE SPAWNING HABITAT AREA AND STREAMFLOW IN THE CARMEL RIVER BETWEEN THE NARROWS AND SAN CLEMENTE DAM, 1992

FIGURE 8-4



SOURCE: D.W. ALLEY ASSOCIATES (1992)

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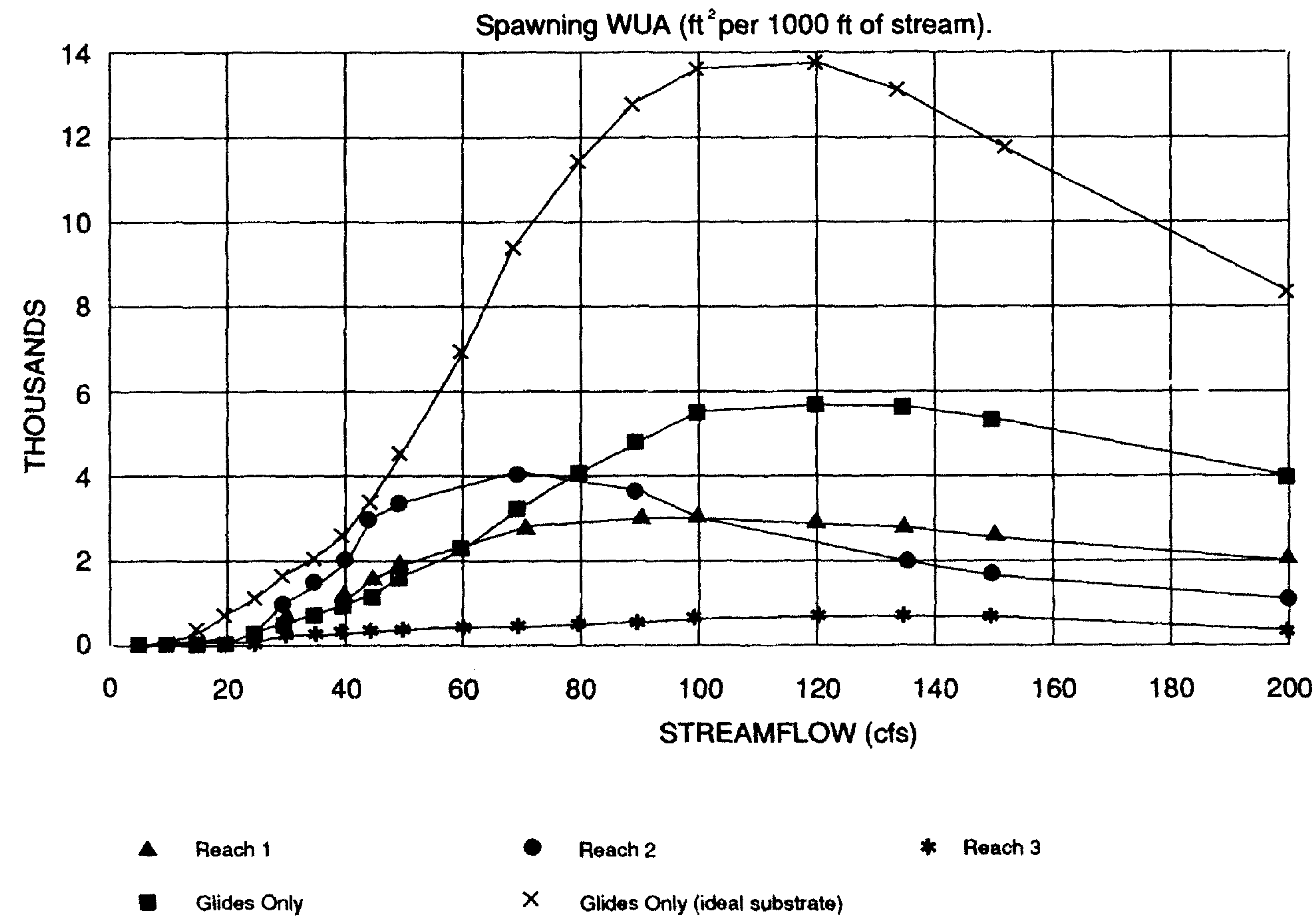
RELATIONSHIP BETWEEN COMPOSITE WEIGHTED USABLE SPAWNING HABITAT AREA AND STREAMFLOW IN THE CARMEL RIVER BETWEEN SAN CLEMENTE RESERVOIR AND LOS PADRES DAM

FIGURE 8-5



SOURCE: ALLEY, HOEFLER, AND MORI (1990)

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reduced to critical levels at flows of about one cfs; pools become separated by long, shallow glides and riffles. Below one cfs, the continuity of the river is broken, and by the end of summer the riverbed is dry. This situation impacts juvenile steelhead by restricting their movement, by isolating them in discontinuous pools, and finally by suffocation as the pools dry up.

To assess the tendency of each alternative to result in a discontinuous river, the CVSIM results were used to determine how often summer flows would recede below one cfs at the Near Carmel gage. A significant adverse impact is defined as an increase in the percentage of years with one or more months with minimum summer flow less than 60 AF per month at the Near Carmel gage as compared to the simulated natural condition. The District record of historical reconstructed flows indicates that the summer flow would drop below one cfs during 42 percent of the 1958-1990 period under natural conditions. This percentage accounts for estimated inflow to the lower Carmel Valley, corrected for evapotranspiration from existing vegetation.

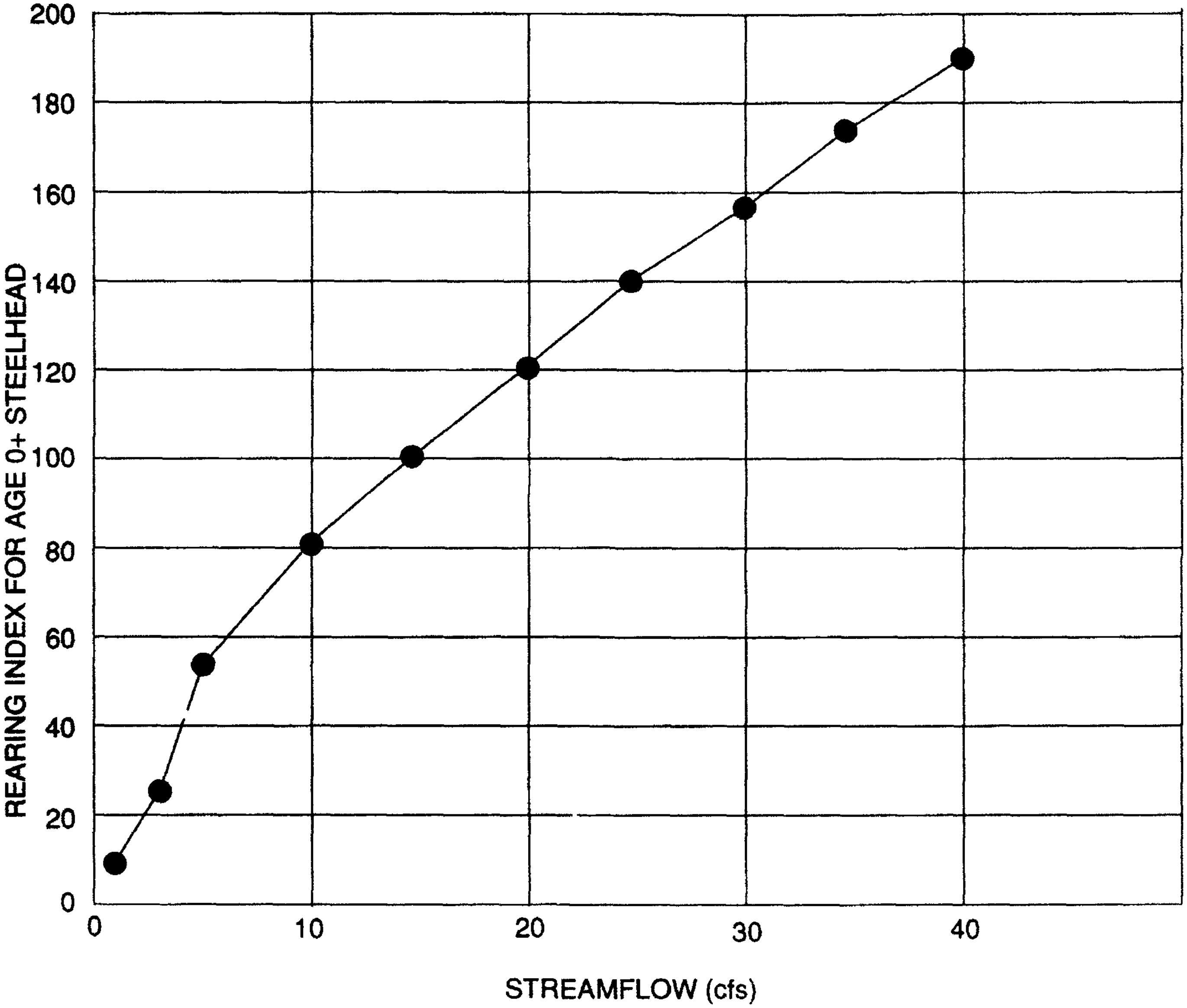
The Narrows to San Clemente Dam: The MPWMD developed methods to estimate the quality and quantity of rearing habitat for young-of-the-year and yearling steelhead in the reach between the Narrows and San Clemente Dam at flows ranging from 5 to 50 cfs.[21] Figure 8-6 illustrates the relationship between rearing habitat and streamflow. It is applied to simulated monthly flows at the Narrows with each water supply alternative.

A significant adverse impact is defined as a decrease of more than one percent in the average minimum annual rearing habitat between the Narrows and the existing San Clemente Dam, as compared to rearing habitat with simulated natural flows at the Narrows. These average 1.35 million RI units for young-of-the-year steelhead and 390,000 RI units for yearling steelhead.

Between San Clemente Reservoir and Los Padres Dam: Figures 8-7 and 8-8 show relationships between rearing habitat for steelhead fry and yearling steelhead, respectively, which were developed based on the USFWS habitat model for rearing habitat.[22] These relationships were applied to simulated monthly streamflow below Los Padres Dam for each alternative. For New San Clemente and New Los Padres Reservoirs, habitat that would be inundated upstream and downstream of the existing dams was accounted for by subtracting the appropriate amount of weighted useable area. A significant adverse impact is defined as a decrease of more than one percent in the average minimum annual weighted usable rearing habitat as compared to rearing habitat with the simulated

RELATIONSHIP BETWEEN INDEX OF REARING HABITAT FOR AGE 0+ STEELHEAD & STREAMFLOW IN THE CARMEL RIVER BETWEEN THE NARROWS AND SAN CLEMENTE DAM

FIGURE 8-6



SOURCE: MPWMD, BASED ON DETTMAN AND KELLEY (1987)

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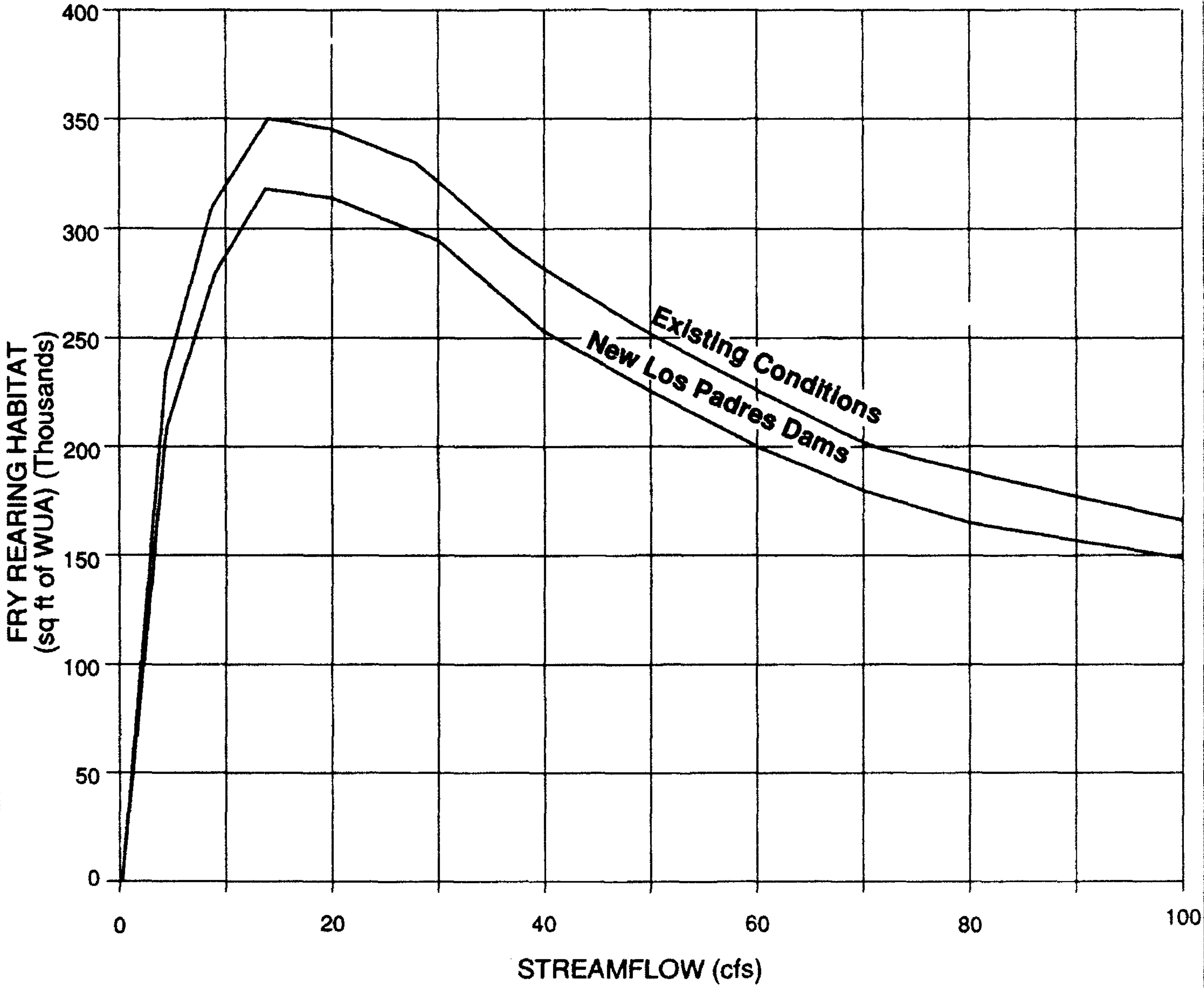
RELATIONSHIP BETWEEN COMPOSITE WEIGHTED USABLE REARING HABITAT AREA FOR STEELHEAD FRY AND STREAMFLOW IN THE CARMEL RIVER BETWEEN SAN CLEMENTE RESERVOIR AND LOS PADRES DAM FIGURE 8-7



SOURCE: MPWMD, BASED ON ALLEY, HOEFLER, AND MORI (1990)

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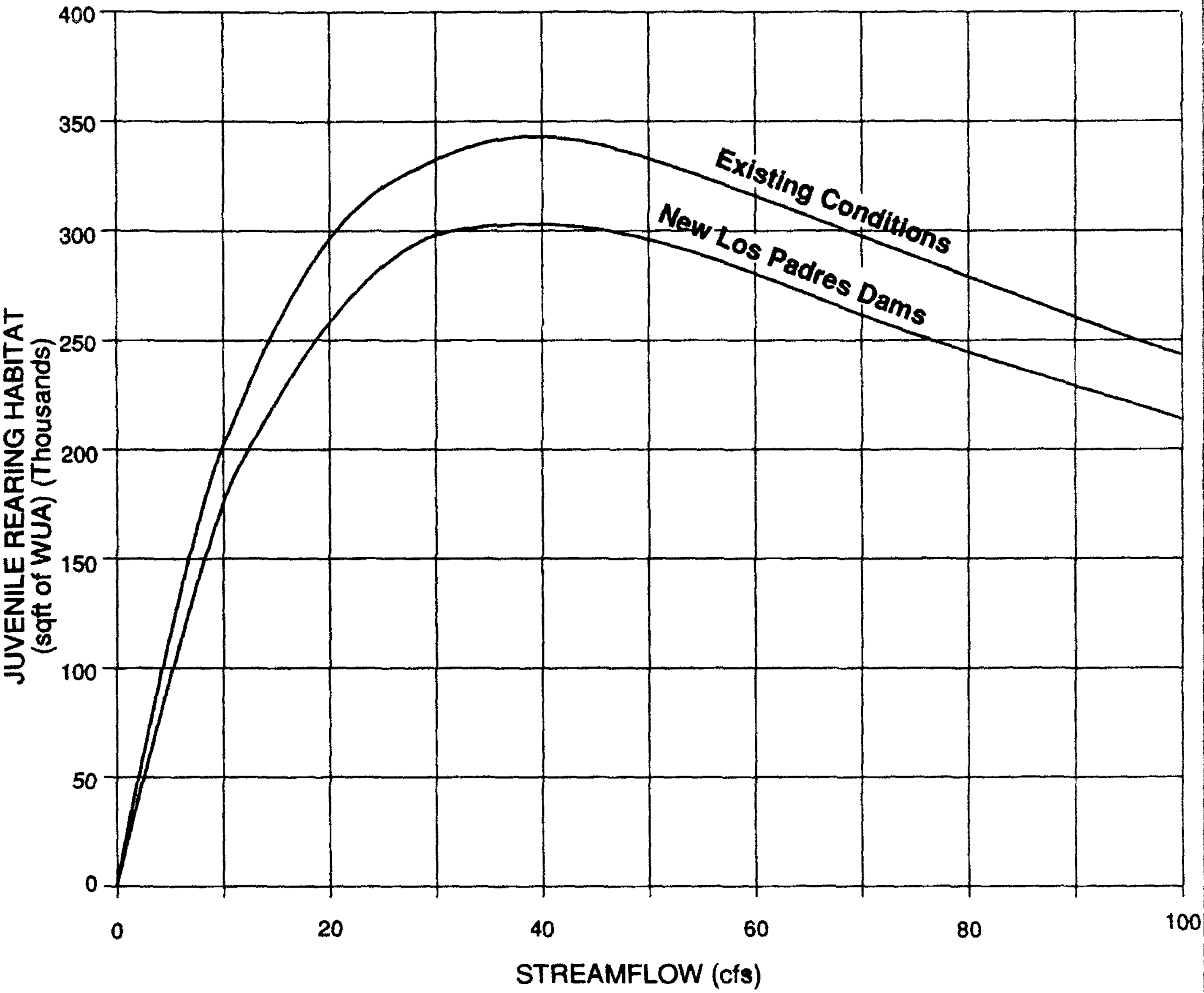
RELATIONSHIP BETWEEN COMPOSITE WEIGHTED USABLE REARING HABITAT AREA FOR JUVENILE STEELHEAD AND STREAMFLOW IN THE CARMEL RIVER BETWEEN SAN CLEMENTE RESERVOIR AND LOS PADRES DAM

FIGURE 8-8



SOURCE: MPWMD, BASED ON ALLEY, HOEFLER, AND MORI (1990)

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natural condition. The one percent standard is based on the best professional judgement of experienced fishery biologists and is consistent with the State and Federal agencies concern over the loss of "critical" habitat.

It is important to note the existing Los Padres Reservoir beneficially impacts summer flows in the river, as compared to natural conditions. Cal-Am maintains a minimum summer release of 5 cfs below Los Padres Dam as part of an agreement with CDFG. This augments summer flows during most years and increases rearing habitat throughout the reach between San Clemente Reservoir and Los Padres Dam.

8.2.6 RISK OF STRANDING JUVENILES DURING FALL-WINTER DOWNSTREAM MIGRATION

In the Carmel River, the initial flows of the water year often spill over San Clemente Dam and percolate into the aquifers downstream of it. At the same time, many juvenile steelhead that have reared upstream or in the vicinity of San Clemente Dam begin to move downstream toward the lagoon. Thus, a substantial portion of the juvenile steelhead that migrate into the reach downstream of the Narrows face a risk of being isolated and stranded as flows decline following storms in late fall and winter. The problem is exacerbated during years when the Carmel Valley aquifer is drawn down during the preceding summer.

For this EIR/EIS, the risk of stranding steelhead was set at a "high" level whenever simulated daily streamflows at the Near Carmel gage or at the Narrows declined to less than one cfs following storms that were likely to stimulate downstream migration. The date of migration was determined by examining simulated daily inflows to Los Padres and San Clemente Reservoirs and flow at the Narrows.

The severity of the isolation risk with each water supply alterative was compared by tallying the simulated number of days with a "high risk" during the period from 1958 thru 1991. For each year, the impact of an alternative was considered significant if more than one simulated high risk day occurred. This standard is based on the District's simulated record of natural flows into the lagoon. As with most perennial streams in central California, the record of natural flows indicates that once the first storms of the year saturate the aquifer and produce a pulse of flow in the lower valley, the Carmel River would continuously flow to the ocean for the remainder of the wet season. The fact

that flows no longer respond in this way is a major constraint to the steelhead population in the Carmel River because a high percentage of larger, older juveniles naturally migrate downstream, without knowing the river will dry-up underneath them.

8.2.7 FLOWS FOR SPRINGTIME EMIGRATION

Adequate April and May streamflows are needed for rearing steelhead smolts below San Clemente Dam and for their emigration from the lower river into the ocean. Previous studies indicate that the quality and quantity of habitat and the survival of emigrating juveniles is related to the magnitude of spring runoff.[23]

Prior to 1960, the diversion of spring flows at San Clemente Dam was a minor problem for emigrating steelhead because no major diversions occurred downstream of the surface diversion at the dam. Following 1959, when Cal-Am began to consistently pump wells in the Carmel Valley alluvial aquifer, there was a gradual, but steady increase in water demand that was met from that aquifer. As groundwater production increased, spring flows in the lower river declined. The decline was further exacerbated by the raising of flashboards at San Clemente Dam each spring, which caused reductions in streamflow and drying of the river below the Narrows.

The impact of these operations on steelhead was documented as early as 1975, when Snider (1983) observed, "A sudden reduction in flow from the lower river in June 1975 resulted in the stranding and eventual loss of numerous downstream migrants, demonstrating that migrants were in the lower river at that time, and that abrupt reductions in flow in June are harmful."[24] Presumably, such flow reductions during April and May were even more harmful because studies of emigration indicate most steelhead smolts emigrate during April and May.

Standards of Significance for Smolt Emigration

Monthly Criteria: The MPWMD developed criteria for mean April through May flows to assess rearing habitat for yearling steelhead and the success of smolt emigration into the ocean.[25] The criteria are based on a correlation between adult counts at San Clemente Dam and spring flows at the Near Carmel gage, rearing habitat versus flow relationships for yearling-sized steelhead, and observations of the flows needed to keep the river mouth open during the spring.

To compare impacts of water supply alternatives on steelhead emigration, these criteria were applied to simulated flows for the period from 1902 to 1991. The frequency of years in each category and the number of years with "zero", "critical" or "poor" conditions were tallied for each alternative. A project was considered to have a significant adverse impact if operations increased the percentage of the April-May periods with "zero," "critical" or "poor" emigration conditions as compared to simulated natural flows. The District's simulated record of natural (unimpaired) flows indicates that 9 percent of April-May periods would have been rated as "zero," "critical" or "poor."

Daily Criteria: To supplement the analysis based on bimonthly criteria, the number of days with a high risk of stranding in April and May was assessed for each alternative. The severity of the isolation and stranding risk was indexed by tallying the annual number of days with flows less than 10 cfs during the April-May period from 1958 to 1991. A significant impact was defined as more than five days with flows less than 10 cfs during the April-May period. This is based on the simulated natural flow record, which indicates that steelhead smolts are subject to isolation risk for an average of five days per year.

8.2.8 FISH PASSAGE FACILITIES

The impacts of fish passage facilities were assessed by comparing the number of days that steelhead would be able to migrate upstream and downstream, by tabulating an index of the time downstream emigration would be delayed by reservoir operations, by qualitatively rating the risk of injury to steelhead during emigration, and comparing the mortality of downstream emigrants. Because upstream passage facilities at San Clemente Dam appear to provide adequate passage, they are not addressed in this report.

8.2.9 TEMPERATURE EFFECTS OF PROJECT OPERATIONS

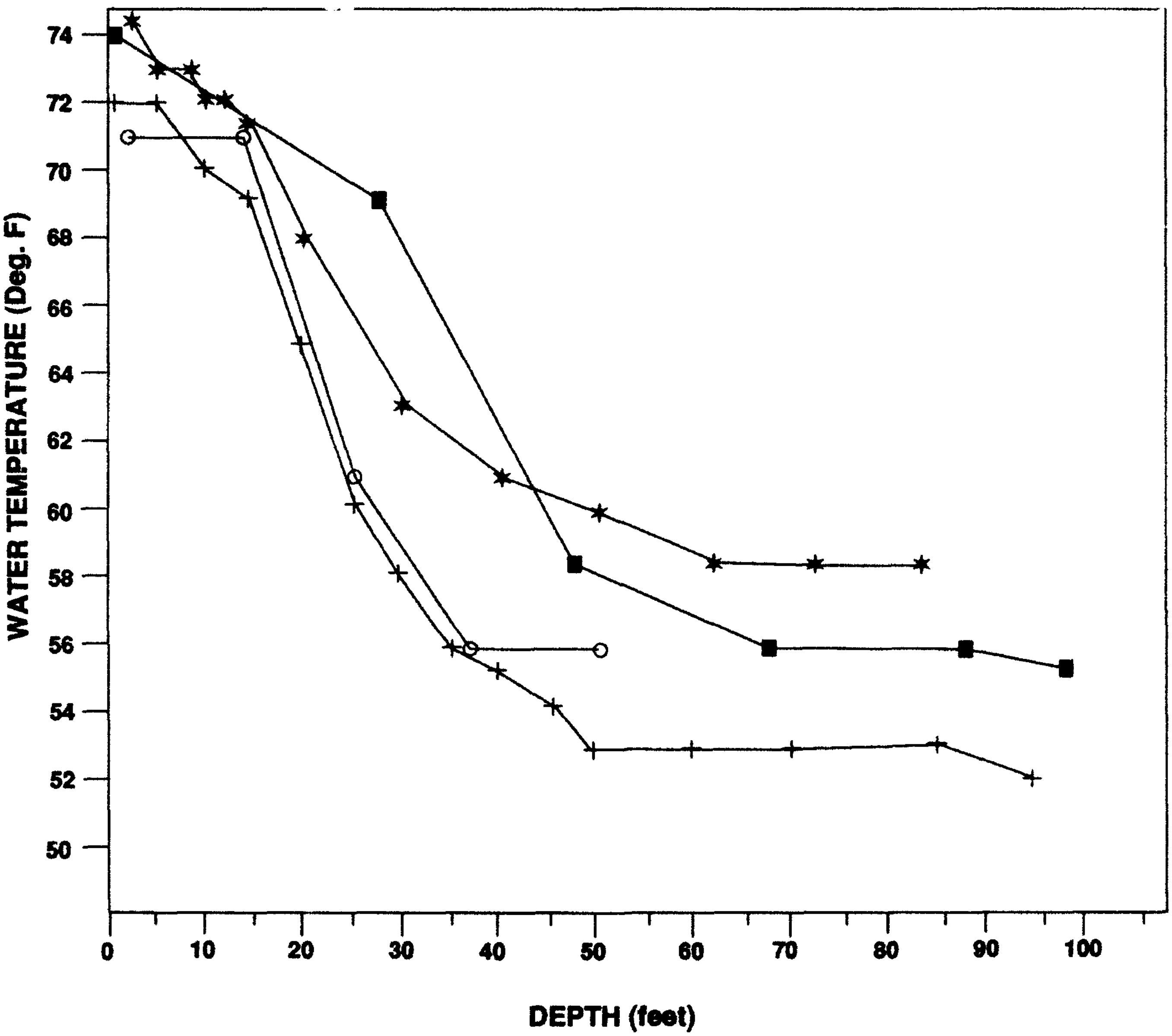
Water temperature is an important factor that directly controls the pace of life for steelhead in central California streams. Unlike mammals and birds, the metabolism of steelhead is set by the temperature of their surroundings. Fish are negatively impacted when water temperatures exceed a narrow optimum range. If water with suboptimum temperatures is released from existing or new reservoirs, it could negatively impact the success of adult spawning, incubation of eggs, and the survival and growth of juveniles.

A precise definition of seasonal water temperatures below storage reservoirs and its impact on egg incubation, juvenile survival, and juvenile growth requires predictions of water temperature based on the results of a reservoir temperature model, coupled with a stream temperature model. The District initiated a contract with Bechtel Civil, Inc. to begin a simulation of water temperatures with each water supply alternative. Bechtel compiled weather data, developed descriptions of reservoir and stream morphology, combined the USFWS stream temperature model with a reservoir temperature model, and calibrated the model with existing reservoirs.

Initially, the District planned to simulate daily water temperatures with each alternative in the 1991 SD EIR/EIS. But following a decision to analyze ten alternatives, the District determined that daily temperature analyses for all alternatives would be too costly, and that detailed simulations of a subset of alternatives would violate the need to analyze alternatives at an equivalent level of detail. Thus, an alternative method used in this document is to compare the ability of each alternative to store and release cool, hypolimnetic (deeper) water during the dry season. Three indices were developed to make this comparison, as described below. Reservoir water temperatures are also discussed in Chapter 7.

With all alternatives, stream temperatures downstream of reservoirs may be unsuitable for juvenile steelhead if hypolimnetic water is exhausted and epilimnetic (surface) water is released from storage during the summer dry season, extending from June through October. Measurements and simulations of water temperature in existing Los Padres and San Clemente Reservoirs and comparisons of epilimnetic depths in central coast reservoirs indicate the depth of epilimnetic water is typically about 30 feet deep at the beginning of June, when reservoirs in this area are normally stratified (Figure 8-9).

On the basis of assumptions that the epilimnetic depth for each reservoir would be 30 feet on June 1 and that any inflow to reservoirs would be cool water, a simple model was developed and merged with CVSIM to index: (1) the volume of hypolimnetic water on June 1; (2) the number of days that hypolimnetic water would be released; (3) the storage of the hypolimnetic volume on October 31; and (4) the number of days that hypolimnetic water could be released during the dry season. This approach provides an accurate way to compare and contrast the ability to release cool water with each water supply alternative.



+ Average of Santa Margarita (6/12/69), San Antonio (5/28/69) and Lopez (6/5/69)

■ Average of Loch Lomond (6/10/75, 6/11/74 and 6/19/73)

✱ Los Padres (8/17/84)

○ San Clemente (8/31/68)

SOURCE: MPWMD, BASED ON CAL-AM DATA; JOHNSON ET AL (1970), CITY OF SANTA CRUZ WATER QUALITY DATA, AND IWATSUBO (1981) 91417

8.2.10 INDEX OF HEALTH OF STEELHEAD RESOURCE

Federal and State resource agencies have requested that the District analyze how the project impacts to each portion of the steelhead lifecycle affect the overall health of the steelhead resource, represented by the number of returning adult steelhead to the Carmel River. The fate of each year class for numerous generations would be tracked over a simulated period of at least three decades. For the Final EIR/EIS, the District will conduct an analysis similar to that used in the evaluation of the New San Clemente Project in 1987. Some of the criteria used in the 1987 study will be revised, based on consultation with the interagency Fishery Working Group; the revised methodology will be applied to the five alternatives in this SD EIR/EIS-II. The results will be prepared in the form of a technical report for the FWG, which will be summarized in the Final EIR/EIS.

8.3 IMPACTS AND MITIGATION MEASURES OF PROJECT ALTERNATIVES

The impact assessment for each alternative addresses four key impact criteria suggested by federal and state resource agencies. They include:

1. The physical impacts of project facilities on steelhead rearing and spawning habitat.

2. How the simulated operation of each alternative would result in streamflow patterns that impact each phase of the steelhead life cycle in the Carmel River. Each simulation assumed a buildout demand of 22,750 AF of annual Cal-Am production. Instream benefits at lower levels of demand would likely be greater than those described below. It should be noted that substantial changes in project operations may result in different streamflow patterns and thus different impacts on steelhead populations.

3. The impact of existing and proposed fish passage facilities on upstream and downstream migration of steelhead.

4. The impact of project operations on water temperature downstream of the reservoir.

All of the analyses first identify impacts prior to consideration of mitigation measures that may lessen the damage to a less than significant level; the overall impact of each alternative with mitigations is then identified.

8.3.1 24,000 AF NEW LOS PADRES RESERVOIR (24 NLP)

INUNDATION AND BLOCKAGE OF SPAWNING HABITAT

Impact 8.3.1-1

The 24 NLP alternative would inundate or block about 12 percent of the spawning habitat in the Carmel Basin. This represents a significant adverse impact.

Construction of a 24,000 AF New Los Padres Reservoir (24 NLP) would inundate 2.1 miles of the Carmel River and Danish Creek, and would effectively block an additional 1.25 miles of habitat for a total of 3.4 miles (Table 8-2). The overall impact would reduce spawning habitat by 14,300 square feet, equivalent to 285 potential nest sites.

Mitigation Measure 8.3.1-1

Spawning habitat would be restored by the methods described in MPWMD Technical Memorandum 90-01, attached as Appendix 8. Initially 538 cubic yards of gravel would be added to the spawning glides between Sleepy Hollow and New Los Padres Dam. The estimated capital cost would be $176,000 with $22,000 annually for operations (Table 8-3). Implementation of this program would fully mitigate inundation impacts to a less than significant level.

In brief, the program would increase and maintain spawning habitat downstream of Los Padres and San Clemente Reservoirs with gravels that were historically trapped in the existing reservoirs. It could also benefit juvenile production as described in Impact 8.3.1-2. Measurements of potential spawning habitat below the two existing reservoirs indicate that the existing spawning habitat is insufficient to saturate the good to excellent juvenile rearing habitat that occurs in these areas. Thus, the mitigation program described below could not only replace the spawning habitat that is inundated, but also increase the production of juvenile steelhead and smolts from the Carmel River.

Key features of the spawning mitigation program include the following:

1) Spawning gravels from deltas at the upstream ends of Los Padres and San Clemente Reservoirs would be collected and stockpiled below existing or new dams. The stockpiles of gravel will be located at the upper end of the reservoir, within the inundation zone, which will prevent impacts to the river downstream of the new dam. Access sites will be at existing crossings and fords, and would have less than significant impacts as compared to existing conditions. Aerial photographs and reconnaissance field investigations indicate the deltas contain ideal mixtures of spawning gravel habitat.

TABLE 8-2

ESTIMATES OF STEELHEAD SPAWNING HABITAT INUNDATED OR BLOCKED BY ALTERNATIVE WATER SUPPLY PROJECTS

Alternative	Length of Stream Inundated (miles)	Length of Stream Blocked (miles)	Length of Stream Total (miles)	Amount of Spawning Habitat Inundated (sq. ft.)	Amount of Spawning Habitat Blocked (sq. ft.)	Amount of Spawning Habitat Total (sq. ft.)	Potential Loss of Nests (no.)	Potential Loss of Nests (%)
24 NLP	2.13	1.25	3.38	10,500	3,800	14,300	285	12
24 NLP/D	2.13	1.25	3.38	10,500	3,800	14,300	285	12
15 CAN/D	0.00	0.00	0.00	0	0	0	0	0
7 DSL	0.00	0.00	0.00	0	0	0	0	0
NO PRJ	0.00	0.00	0.00	0	0	0	0	0

Note: Based on measurements of spawning habitat in the Carmel River and selected tributaries during 1982 and 1989. See MPWMD Technical Memorandum 89-03 for detailed accounting of habitat inundated by projects.

Source: MPWMD

TABLE 8-3

SUMMARY OF COST ESTIMATES FOR MITIGATING THE LOSS OF SPAWNING HABITAT INUNDATED OR BLOCKED IN THE CARMEL RIVER BASIN WITH ALTERNATIVE WATER SUPPLY PROJECTS

Alternative	Initial Cost	Annual Operation Cost
24 NLP	$176,000	$23,300
24 NLP/D	176,000	23,300
15 CAN/D	0	0
7 DSL	0	0
NO PRJ	0	0

Source: MPWMD

2) Gravel would be initially placed in glides downstream of the existing reservoirs where hydraulic conditions are suitable for spawning habitat, but where scour has reduced the abundance of gravel. MPWMD has conducted a detailed survey of spawning habitat and located 76 glides which are suitable for the mitigation program.

3) MPWMD would carry out long-term, periodic monitoring of key spawning glides pursuant to an agreement with CDFG and other responsible fishery agencies. At a minimum, this would include annual monitoring to measure spawning habitat and ensure that enough additional habitat is maintained to offset the losses caused by inundation. During wet years monitoring would probably be needed between major storms.

4) MPWMD would implement a program to inject gravel into the river downstream of existing or new dams. During the first years of operation gravel bedload transport rates would be measured to develop transport curves at locations near spawning glides. The curves would be used as guidelines for injecting gravel during winter storms. Gravel from the stockpiles would be added at several locations including: below existing Los Padres Dam (River mile [RM] 23.5, or New Los Padres Dam (RM 23.0), Flavin's Crossing (RM 22.0), Syndicate Camp (RM 21.5), below San Clemente Dam (RM 18.1), and San Clemente Ford (RM 17.3).

INUNDATION AND BLOCKAGE OF REARING HABITAT

Impact 8.3.1-2

The 24 NLP alternative would inundate or block about 12 percent of the rearing habitat for age 0+ steelhead and about 14 percent for yearlings when compared to the existing situation. This would result in a significant adverse impact.

Construction of a 24,000 AF New Los Padres Reservoir would inundate or block a total of 3.4 miles of rearing habitat on the Carmel River and Danish Creek. Using the Rearing Index, about 1.5 million units for age 0+ steelhead and 0.8 million units for yearlings would be lost. The percent equivalent is shown in Table 8-4 for all alternatives.

Mitigation Measure 8.3.1-2

MPWMD would mitigate these impacts by releasing flow from the New Los Padres Reservoir as part of the normal operation schedule. Section 4.1.4 provides a description of the operation rules to achieve this goal. A substantial improvement in streamflow would be gained by these mitigation measures, which would result in a beneficial impact on rearing habitat.

The proposed operation of the 24,000 AF New Los Padres Reservoir would increase age 0+ juvenile rearing habitat by 3.7 million RI units over the unimpaired or "natural" (NATL) condition, or more

TABLE 8-4

ESTIMATES OF THE QUALITY AND QUANTITY OF YOUNG-OF-THE-YEAR AND YEARLING STEELHEAD REARING HABITAT INUNDATED OR BLOCKED BY ALTERNATIVE WATER SUPPLY PROJECTS

Habitat Alternative	Length of Stream Inundated	Length of Stream Blocked	Length of Stream Total	Amount of Age 0+ Habitat			Amount of Yearling		
	(miles)	(miles)	(miles)	(sq. ft.)	(RI units)	(% change)	(sq. ft.)	(RI units)	(% change)
24 NLP	2.13	1.25	3.38	301,200	1,537,000	-12	238,600	804,000	-14
24 NLP/D	2.13	1.25	3.38	301,200	1,537,000	-12	238,600	804,000	-14
15 CAN/D	0.00	0.00	0.00	0	0	0	0	0	0
7 DSL	0.00	0.00	0.00	0	0	0	0	0	0
NO PRJ	0.00	0.00	0.00	0	0	0	0	0	0

Note: Based on measurements of depth, velocity, cobble abundance, cobble embededness, and cover in the Carmel River and selected tributaries during 1982 and 1989 and application of habitat model developed by Dettman and Kelley (1986). See MPWMD Technical Memorandum 90-03 for detailed accounting of habitat inundated by projects.

Source: MPWMD

than double the 1.5 million units of rearing habitat inundated by the project (Table 8-5). This project would enhance rearing habitat for juvenile steelhead.

IMPACTS OF PROJECT OPERATION

Flows for Adult Upstream Migration

Impact 8.3.1-3

Operation of 24 NLP at buildout demand levels would significantly reduce opportunities for upstream migration by limiting the duration of attraction flows, shortening the duration of the migration season and increasing the number of years without attraction flows.

At buildout demand levels, the 24 NLP alternative would meet the modified CDFG seasonal criteria in 66 percent of the years and achieve a "fair" or better rating with the DWK monthly criteria in 41 percent, 67 percent, and 73 percent of the Januaries, Februaries, and Marches, respectively (Table 8-6). As compared to natural (unimpaired) flows, the operation of 24 NLP would adversely impact upstream migration by reducing the percentage of years with flows exceeding the seasonal criteria. Based on seasonal criteria, performance in terms of attracting adult steelhead would be similar to the No Project condition.

On average, the 24 NLP would provide 26 days of attraction flows (minimum flows ranging from 75 to 200 cfs, depending on year type), and would provide about 2 weeks of attraction flows during most dry, below normal, above normal and wet years (Table 8-7). The alternative would fall short on attraction events primarily during critical years; on average there is only one day of attraction flows during critical years. This represents a significant negative impact as compared to an average of 5 days under natural conditions, but is a similar impact as compared to the No Project condition.

On average, the duration of the migration season would be 48 days, which is about one week shorter than under natural conditions, but three days longer than with the No Project (Table 8-8). Most of the impact would occur during below normal, dry and critical years, when the average duration would be reduced by 6 days in below normal years, 8 days in dry years and 9 days in critical years, compared to natural conditions (Table 8-8).

TABLE 8-5

AMOUNT OF JUVENILE REARING HABITAT INUNDATED BY WATER SUPPLY ALTERNATIVES AND NET IMPACT OF STREAMFLOW RELEASES ON REARING HABITAT FOR AGE 0+ STEELHEAD IN THE CARMEL RIVER DURING PERIOD 1902 THROUGH 1991

Habitat Alternative	Habitat Inundated (sq. ft.)	Habitat Inundated (RI units)	Average Minimum Streamflow (cfs) SCR to LPD	Average Minimum Streamflow (cfs) Narrows	Habitat With Proposed Operation (RI units) SCD to LPD	Habitat With Proposed Operation (RI units) Nar to SCD	Habitat With Proposed Operation (RI units) Total	Net Change In Rearing Habitat (RI units)
24 NLP	301,200	1,537,000	18.3	12.3	1,730,000	3,900,000	5,630,000	3,690,000
24 NLP/D	301,200	1,537,000	18.3	11.2	1,730,000	3,680,000	5,410,000	3,470,000
15 CAN	0	0	5.3	2.2	1,100,000	1,090,000	2,190,000	250,000
7 DSL	0	0	5.3	2.2	1,100,000	1,090,000	2,190,000	250,000
NO PRJ	0	0	5.3	2.2	1,100,000	1,110,000	2,210,000	270,000
NATL	0	0	2.4	3.2	580,000	1,360,000	1,940,000	---

Source: MPWMD

TABLE 8-6

PERCENTAGE OF SEASONS OR MONTHS THAT FLOWS FOR UPSTREAM MIGRATION WOULD MEET SEASONAL AND MONTHLY CRITERIA WITH WATER SUPPLY ALTERNATIVES.
Based on Simulated Monthly Streamflows During 1902-1991 Period.
CVSIM Dated 7 May 1992 for 23 November 1991 for Natural Conditions.

	Modified CDFG[1] Seasonal Bypass Flow (% of seasons)			D.W. Kelley Criteria[2] (% of months)		
Alternative	Dry & Critical	Other	Total	Jan	Feb	Mar
24 NLP	1%	64%	66%	41%	67%	73%
24 NLP/D	1%	64%	66%	43%	70%	77%
15 CAN/D	0%	68%	68%	50%	71%	71%
7 DSL	1%	69%	70%	44%	68%	71%
NO PRJ	1%	68%	69%	41%	67%	71%
NATL	11%	71%	82%	66%	81%	88%

1 Based on CDF&G recommendation of 200 cfs for 18 days and modified by changing requirement for transportation flows from 40 cfs to 60 cfs for 72 days and by adopting a sliding scale for attraction flows in dry and critical years whereby attraction requirement is 100 cfs during February and 75 cfs during March. With this criteria runoff totals 15,800 AF in below and above normal years, and 13,000 acre in dry and critical years.

2 Based on modification to criteria developed by Dettman and Kelley (1987 & 1989). During below and above normal years runoff totals 4,158 AF during February and 4,475 AF during January and March. With adoption of sliding scale for attraction flows, runoff totals 3,366 AF during February and 3,485 AF during March of dry and critically-dry years.

Source: MPWMD

TABLE 8-7

NUMBER OF DAYS PER YEAR THAT RECOMMENDED FLOWS FOR ATTRACTION OF ADULT STEELHEAD WERE EQUALED OR EXCEEDED[1]

	Number Of Days With Attraction Flows By Year Type[2]						Number & Percentage of Years Without Attraction Flows	
Alternative	Average	Wet	Above Normal	Below Normal	Dry	Critical	(no.)	(%)
24 NLP	26	61	34	12	12	1	7	21
24 NLP/D	26	62	35	13	13	2	6	18
15 CAN/D	28	62	37	14	16	2	5	15
7 DSL	26	61	37	14	12	1	5	15
NO PRJ	26	59	37	13	12	1	5	15
NATL	31	64	40	16	23	5	4	12

1 Based on simulated daily streamflows during the period 1958 to 1991.

2 Based on CDFG and D.W. Kelley (1986) recommended flow of 200 cfs into lagoon to attract adult steelhead into the Carmel River and D.W. Kelley (1986) criteria for sliding scale of requirements to attract steelhead into the Carmel River.

Source: MPWMD

TABLE 8-8

DURATION OF ADULT MIGRATION SEASON IN THE CARMEL RIVER FROM 1958 TO 1991[1]

	Average Duration of Upstream Migration Season (days) By Year Type[2]					
Alternative	Average	Wet	Above Normal	Below Normal	Dry	Critical
24 NLP	48	77	72	59	28	2
24 NLP/D	51	80	74	65	32	3
15 CAN/D	44	76	69	43	25	4
7 DSL	45	78	73	47	19	2
NO PRJ	45	77	72	50	21	1
NATL	54	80	75	65	37	11

1 Based on simulated daily streamflows and flows recommended by CDFG for transportation of adult steelhead in the lower Carmel River.

2 Duration of adult migration season defined by the number of days with flows exceeding 60 cfs into the lagoon for transportation of adult steelhead int he Lower Carmel River. The criteria is intermediate between CDF&G original recommendation of 40 cf and D.W. Kelley & Associates recommendation of 75 cfs. It is based on recent (1991) measurements of depth across shallowest critical riffles in the lower river between Highway One bridge and Schulte Road bridge.

Source: MPWMD

Since publication of the 1991 Supplemental Draft EIR/EIS, the District, with cooperation from CDFG and NMFS, investigated ways to change the operation of the 24 NLP alternative to improve performance in regards to upstream migration flows. In the 1991 SD EIR/EIS, the performance of this project was poorer than the No Project condition. Efforts to modify the operations, without unduly reducing performance for other portions of the lifecycle and for water supply, were successful. Based on the tabulation of the number of attraction and transportation days, listed in Tables 8-7 and 8-8 the performance is similar or better than the No Project condition. However, as compared to natural conditions it has significant negative impacts during dry and critical years. At Cal-Am demands levels of about 23,000 AF it may be unreasonable to expect that the impacts during critically dry years could be mitigated by additional changes to the operation schedule of any new reservoir in the Carmel River Basin.

Mitigation Measure 8.3.1-3

The District suggests that two mitigation measures be investigated by the Fisheries Working Group for mitigation of impacts on adult migration during drought years: (1) artificially attracting adult steelhead into the lagoon and transporting them above the Narrows where flows are sufficient for migration and spawning; and (2) rearing a contingent of adult steelhead in a saltwater facility for release into the river if flow conditions are insufficient. Since publication of the 1991 SD EIR/EIS, changes in the operation schedule have substantially improved upstream migration conditions, compared to the existing situation. However, additional improvement to upstream migration opportunities, via changes to the operation schedule, is unlikely during extended droughts, without jeopardizing the viability of summer rearing habitat upstream of the Narrows and the water supply performance. If measures (1) or (2) were implemented, then impacts on upstream migration would be reduced, but full mitigation would be unlikely. Thus, this impact is considered to be an unavoidable significant impact. It is important to note that these unmitigated impacts would only occur during severe drought conditions, such as the 1987-1992 event.

Flows for Steelhead Spawning Habitat

Impact 8.3.1-4

Compared to natural conditions, the operation of 24 NLP would significantly increase spawning habitat downstream of Los Padres Dam. This represents a significant beneficial impact.

Downstream of San Clemente Dam: A significant negative impact on spawning habitat between the Narrows and San Clemente Dam was identified in the 1991 Supplemental Draft EIR/EIS. The FWG investigated whether the operation rules could be changed to mitigate for impacts on spawning

habitat. The FWG found that it was possible to improve performance by establishing minimum spawning flow requirements at the Narrows during February and March. Minimum flow requirements have been incorporated into the operations schedule (Table 4-4). The requirement is set to 30 cfs in critical years, 50 cfs in dry years, and 70 cfs in below normal or better years. The requirements were developed by calculating the average weighted useable spawning area during different types of water years under natural flow conditions.

In the reach between the Narrows and San Clemente Dam, the operation of 24 NLP would reduce average February flows at the Narrows by 59 cfs and March flows by 28 cfs. This flow reduction and the mitigation program for improving substrate conditions would provide a total of 18,200 units of WUA, which is a beneficial impact compared to the No Project and Natural flow conditions (Table 8-9).

Between San Clemente and Los Padres Dams: Table 8-10 lists the total weighted useable spawning habitat area (WUA) between the dams during selected years of the simulated 89-year record. These years were selected because a comparison could be made across all alternatives in February and March. These years cover a broad spectrum of critical, dry, below normal and above normal years, but do not include wet years, when the projects have negligible impacts on flow. Thus, the selected years provide an accurate description of impacts on spawning habitat, when the project is able to control flows.

During the selected years, operation of the 24,000 AF New Los Padres Reservoir would increase the average WUA from 8,100 to 14,000 units, or a 73 percent increase (Table 8-10). This is caused by streamflow reductions during some years, which increase spawning habitat, and by the addition of spawning gravels, which is part of the proposed spawning habitat mitigation program (See Section 8.3.1).

The increase in spawning habitat upstream of the Narrows would be enough to compensate for the loss of habitat inundated by the new reservoir and by operational impacts. Overall, the 24 NLP would increase spawning habitat from 23,600 units to 32,000 units, which is significant beneficial impact.

TABLE 8-9

GRAND AVERAGE OF MONTHLY WEIGHTED USABLE SPAWNING AREA (WUA) BETWEEN THE NARROWS AND SAN CLEMENTE DAM WITH ALTERNATIVE WATER SUPPLY PROJECTS

Based on simulated unimpaired flows, dated November 23, 1991; simulated No Project, CVSIM dated May 7, 1992; and simulated water supply alternatives, dated October 2, 1992, and relationship between weighted usable spawning habitat area versus streamflow from Alley (1992).

		24 NLP[1]		24 NLP/D		15 CAN/D	7 DSL	NO PRJ	NATUR
Month	No.[2] Years	Exist (sqft)	MitPlan (sqft)	Exist (sqft)	MitPlan (sqft)	Exist (sqft)	Exist (sqft)	Exist (sqft)	Exist (sqft)
January	64	4,674	5,913	5,031	6,360	6,024	6,000	5,885	6,649
February	56	6,823	8,747	6,990	8,958	7,252	7,246	7,252	7,669
March	54	7,376	9,425	7,309	9,382	7,474	7,463	7,464	7,874
TOTAL (Feb. & Mar.)		14,200	18,200	14,300	18,300	14,700	14,700	14,700	15,500

[1] Exist – Existing substrate conditions.
MitPlan – Substrate conditions maintained with proposed fisheries mitigation plan.

[2] Number of years with average monthly flows less than or equal to 260 cfs. Relationship between WUA and flow available at flows ranging from 5 to 260 cfs.

Source: MPWMD

TABLE 8-10

GRAND AVERAGE OF MONTHLY WEIGHTED USABLE SPAWNING AREA (WUA) BETWEEN SAN CLEMENTE RESERVOIR AND LOS PADRES DAM WITH ALTERNATIVE WATER SUPPLY PROJECTS

Based on simulated unimpaired flows, dated November 23, 1991; simulated No Project, CVSIM dated May 7, 1992; and simulated water supply alternatives, dated October 2, 1992, and relationship between weighted usable spawning habitat area versus streamflow from Alley (1992).

Month	No.[2] Years	24 NLP[1] Exist (sqft)	24 NLP[1] MitPlan (sqft)	24 NLP/D Exist (sqft)	24 NLP/D MitPlan (sqft)	15 CAN/D Exist (sqft)	7 DSL Exist (sqft)	NO PRJ Exist (sqft)	NATUR Exist (sqft)
January	69	1,642	3,138	1,848	3,552	3,060	3,053	3,054	3,205
February	57	3,011	6,092	2,962	5,687	3,841	3,835	3,833	3,855
March	58	4,103	7,891	4,068	7,825	4,362	4,256	4,272	4,279
TOTAL (Feb. & Mar.)		7,100	14,000	7,000	13,500	8,200	8,100	8,100	8,100

[1] Exist – Existing substrate conditions.
MitPlan – Substrate conditions maintained with proposed fisheries mitigation plan.

[2] Number of years with average monthly flows less than or equal to 200 cfs. Relationship between WUA and flow available at flows ranging from 5 to 200 cfs.

Source: MPWMD

Mitigation Measure 8.3.1-4

Mitigation for impacts on spawning habitat requires implementation of measures described in Impact 8.3.1-1 and flow releases from New Los Padres and San Clemente dams to meet flow requirements at the District's streamflow gaging station located in Garland Park at Don Juan Bridge, and at the fish barrier dam below New Los Padres Dam. No additional measures will be needed, but substrate composition and habitat use should be monitored each year at selected key spawning glides to insure the success of the mitigation measures.

Flows for Juvenile Rearing Habitat

Impact 8.3.1-5

Overall, the summer, fall and early winter flow releases from the 24 NLP alternative would provide beneficial impacts to fry and juvenile steelhead by increasing habitat in the Carmel River, and would mitigate for inundation from the dam (Table 8-5). Steelhead fry habitat in the reach between the dams would be maintained at the same level as with natural flows, and the seasonality of streamflow in the river below the Narrows would be reduced.

Near Carmel to the Narrows: Compared to natural flow conditions, the operation of the 24,000 AF reservoir would slightly reduce the percentage of years when the lower river dries up from 44 to 41 percent (Table 8-11). This would be a beneficial impact (Table 8-11).

Narrows to San Clemente Dam: Compared to natural flows, the operation of the 24,000 AF reservoir would increase the average minimum summer flow at the Narrows from 3.2 cfs to 12.3 cfs (Figure 8-10). The increased flow would provide 3.9 million rearing index units of age 0+ juvenile habitat in the reach between the Narrows and San Clemente Dam, or a 187 percent increase in habitat as compared to the 1.4 million units with natural flows (Table 8-12). The project operation would increase habitat for yearling steelhead from 0.4 to 1.7 million units, which would be a beneficial impact.

Between San Clemente and Los Padres Dams: The operation of the 24,000 AF reservoir would increase the average minimum late spring and early summer flow below the Los Padres Dam from 19.9 to 31.9 cfs (Figure 8-11). This increased flow would reduce habitat for steelhead fry from an average 284,000 WUA units to 278,000 units, or about 2 percent (Table 8-13). While this impact would be defined as significant, given the rigorous standard that a one percent loss is significant, the impact would be balanced by additional habitat created in the river below San Clemente Dam. Thus the net impact would be classified as less than significant.

TABLE 8-11

NUMBER AND PERCENTAGE OF YEARS THAT JUVENILE STEELHEAD WOULD BE STRANDED DURING DRY SEASONS[1]

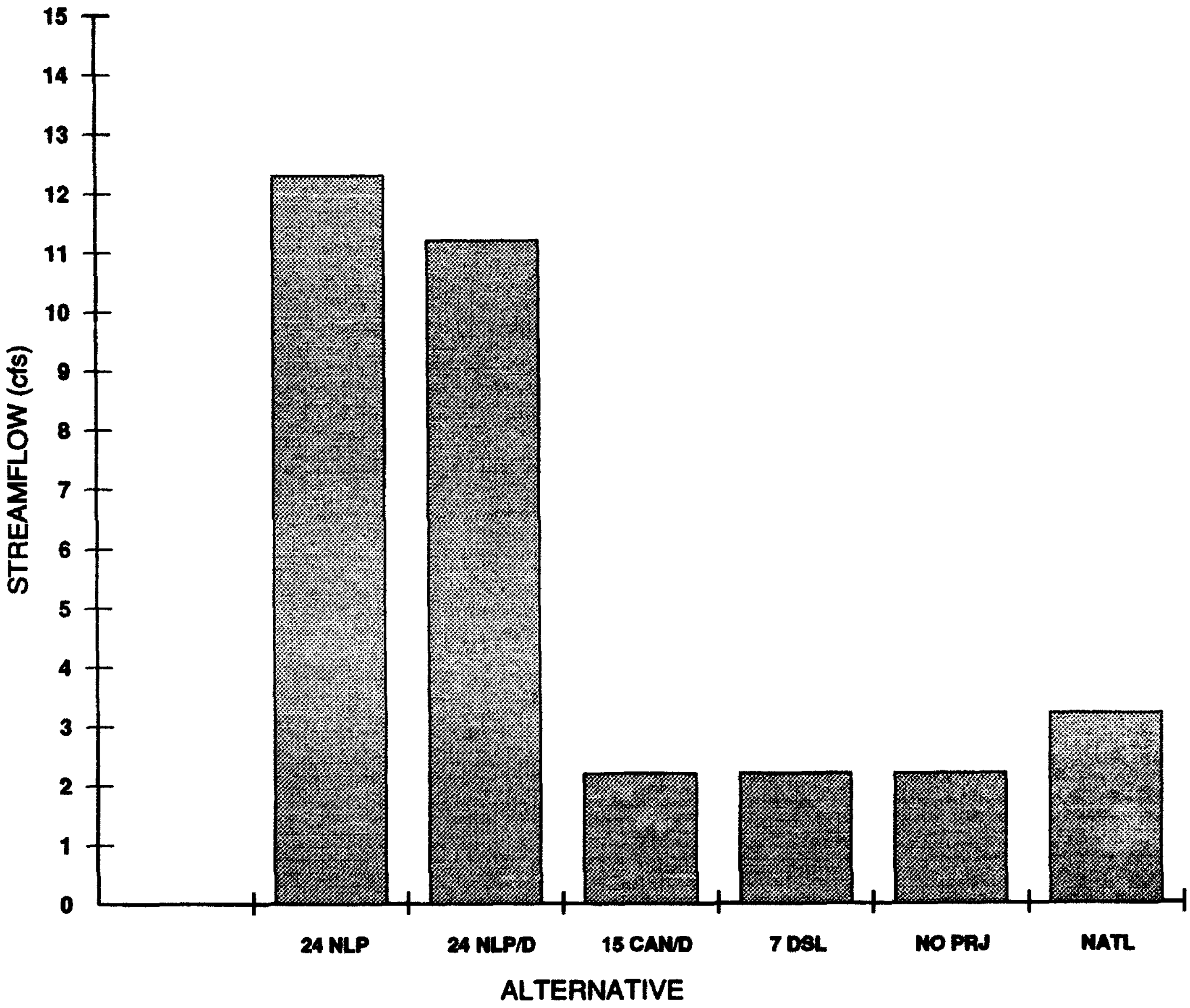
	Number and Percentage of Years With Juveniles Stranded In Reach From			
	Robles to Narrows[2]		Narrows to Carmel[3]	
Alternative	(no. yrs)	(%)	(no. yrs)	(%)
24 NLP	10	29	14	41
24 NLP/D	10	29	12	35
15 CAN/D	33	97	14	41
7 DSL	33	97	14	41
NO PRJ	28	82	33	97
NATL[4]	NA	NA	15	44

[1] Based on simulated flows during period from July 1958 to September 1991 in two reaches between USGS gages near Carmel and Robles del Rio.
[2] Years with less than 5 cfs mean monthly flow at the Narrows.
[3] Years with less than 1 cfs mean monthly flow at near Carmel.
[4] Natural flow based on unimpaired inflow at Carmel, adjusted for mean monthly evapotranspiration of riparian vegetation in Carmel Valley. Estimates not available for Narrows.

Source: MPWMD

AVERAGE MINIMUM MEAN MONTHLY FLOWS AT THE NARROWS DURING THE LATE SUMMER-EARLY FALL SEASON WITH ALTERNATIVE WATER SUPPLY PROJECTS

FIGURE 8-10



SOURCE: MPWMD

91417

TABLE 8-12

MINIMUM SEASONAL REARING HABITAT FOR AGE O+ AND YEARLING STEELHEAD IN THE CARMEL RIVER BETWEEN THE NARROWS AND SAN CLEMENTE DAM WITH ALTERNATIVE WATER SUPPLY PROJECTS AND NATURAL FLOW CONDITIONS DURING THE PERIOD 1902 THROUGH 1991

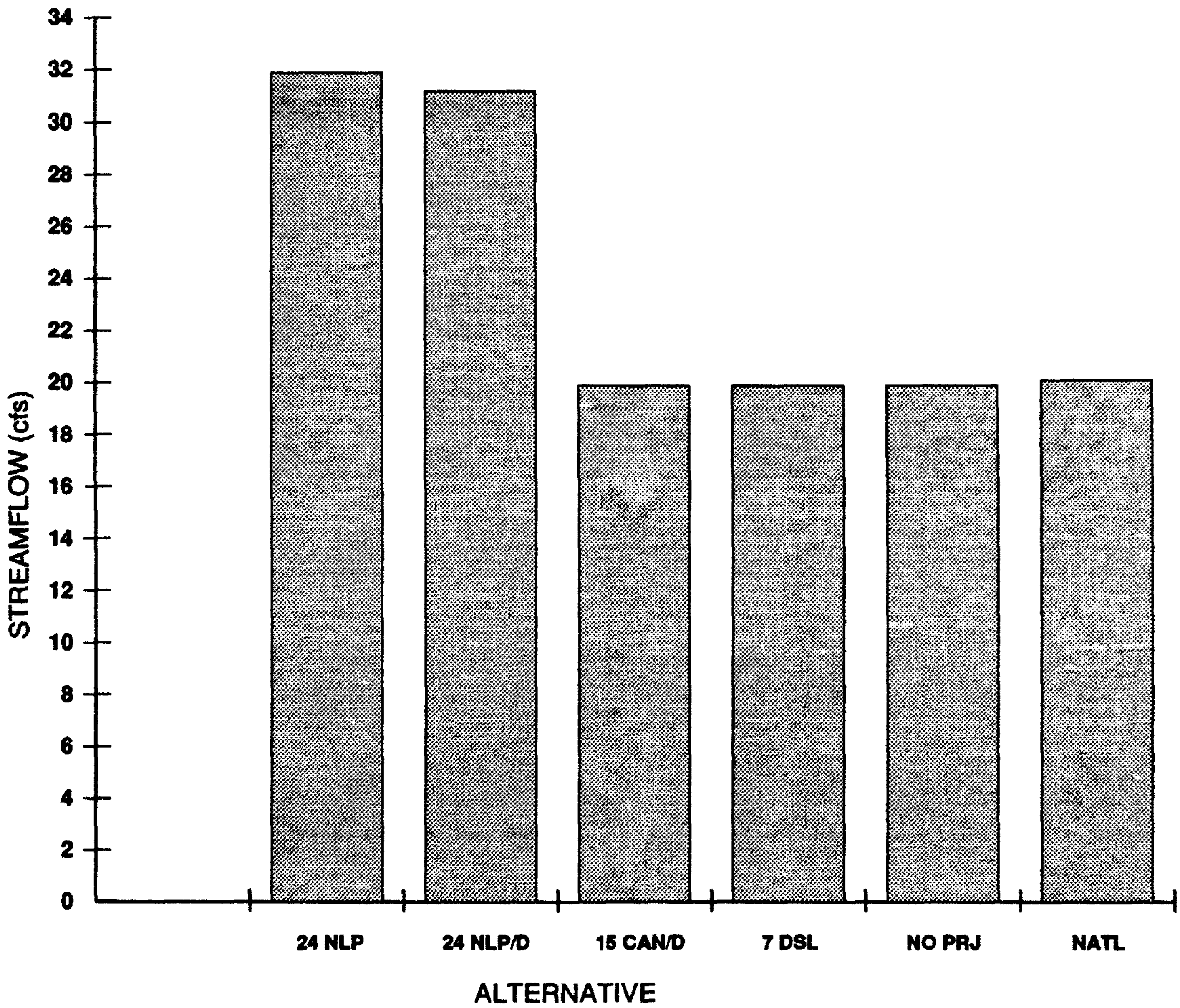
Based on simulated unimpaired flows dated November 23, 1991; simulated No Project dated May 7, 1992; other alternatives dated October 2, 1992; and relationships between index of rearing habitat for juvenile steelhead and streamflow in the Carmel River between the Narrows and San Clemente Dam.

	Average Minimum Seasonal Habitat			
	Young-of-the-Year		Yearlings	
Alternative	(RI units)	% change	(RI units)	% change
24 NLP	3,900,000	187%	1,690,000	333%
24 NLP/D	3,680,000	171%	1,530,000	292%
15 CAN/D	1,090,000	-20%	250,000	-36%
7 DSL	1,090,000	-20%	250,000	-36%
NO PRJ	1,110,000	-18%	250,000	-36%
NATL	1,360,000		390,000	

Source: MPWMD, modified from Dettman and Kelley, 1986.

AVERAGE MINIMUM MEAN MONTHLY FLOWS BELOW LOS PADRES DAM DURING THE LATE SPRING-EARLY SUMMER SEASON WITH ALTERNATIVE WATER SUPPLY PROJECTS

FIGURE 8-11



SOURCE: MPWMD

91417

TABLE 8-13

MINIMUM SEASONAL WEIGHTED USABLE HABITAT FOR FRY AND JUVENILE IN THE REACH BETWEEN SAN CLEMENTE RESERVOIR AND LOS PADRES DAM

	Average Seasonal Habitat			
	Steelhead Fry		Steelhead Juveniles	
Alternative	(WUA units)	% change	(WUA units)	% change
24 NLP	278,000	-2.1	285,000	360
24 NLP/D	281,000	-1.1	295,000	376
15 CAN/D	301,000	6.0	143,000	131
7 DSL	301,000	6.0	142,000	129
NO PRJ	301,000	6.0	143,000	131
NATL	284,000		62,000	

[1] Based on simulated flows from late spring through early summer (Fry Habitat) and mid-summer through early winter (Juvenile Habitat); unimpaired flows, CVSIM dated November 23, 1991; simulated No Project dated May 7, 1992; other projects, CVSIM dated October 2, 1992; and relationship between weighted useable habitat for fry, juvenile, and streamflow in the reach between San Clemente Reservoir and Los Padres Dam (adapted from Alley, 1990; Tables 5 and 6).

Source: MPWMD

The operation of the 24,000 AF reservoir would increase the average late summer, minimum flow below Los Padres Dam from 2.4 to 18.3 cfs, which would increase habitat for juvenile steelhead from an average 62,000 WUA units to 285,000 WUA units, or a 360 percent increase (Table 8-13). This would be a beneficial impact.

Mitigation Measure 8.3.1-5

No additional mitigation measures are required for operation impacts. It should be noted, however, that the District will mitigate for the 24 NLP inundation impacts on rearing habitat with streamflow releases, except when reservoir storage is depleted during severe droughts.

When the project is not able to maintain the flows needed to rear juveniles throughout the entire summer, the District would mitigate impacts by rescuing and rearing juveniles throughout the remainder of the dry season. With the 24 NLP, this type of program would probably not be necessary because the project reduces impacts as compared to natural flows. However, to ensure that the inundated habitat is fully mitigated, the District may continue to rescue and rear juveniles with this alternative. The program would be needed during 38 percent of the years and would operate an average of three months per year during those periods. Operation costs for this program would average $24,000 per year, and range from $0 to $97,000 per year (Table 8-14).

Flows for Fall-Winter Downstream Migration

Impact 8.3.1-6

Compared to simulated natural flows, the operation of the 24,000 AF New Los Padres Reservoir would increase the risk that juvenile steelhead will be stranded in the Carmel River downstream of Robles del Rio. When compared to the No Project situation, the risk of stranding would be substantially reduced.

Simulated natural flows would never result in isolation or stranding. The 24 NLP would substantially reduce the occurrence of this risk, as compared to other alternatives. During the 13 years (38 percent of years studied) when a risk would occur, the number of days with high risk would average 69 per year (Table 8-15).

Overall, this impact would be considered significant, compared to natural conditions, but beneficial when compared to existing conditions.

TABLE 8-14

SUMMARY OF ESTIMATED ANNUAL OPERATION COSTS FOR HOLDING AND REARING JUVENILE STEELHEAD IN FACILITY DOWNSTREAM OF SAN CLEMENTE DAM WITH ALTERNATIVE WATER SUPPLY PROJECTS

		Annual Operation Costs[2]		
Alternative	Initial Cost[1]	Average	Minimum	Maximum
24 NLP	$0	24,000	$0	$97,000
24 NLP/D	0	24,000	0	97,000
15 CAN/D	0	41,000	0	97,000
7 DSL	0	49,000	0	97,000
NO PRJ	0	49,000	0	97,000

[1] Facilities will be constructed as part of District's mitigation program for Allocation EIR.
[2] Based on MPWMD CVSIM during period from 1958 to 1991.

Source: MPWMD

TABLE 8-15

NUMBER OF DAYS DURING THE OCTOBER THROUGH MARCH PERIOD THAT JUVENILE STEELHEAD WOULD BE AT HIGHER RISK OF STANDING IN THE REACH FROM THE LAGOON TO ROBLES DEL RIO[1]

Alternative	Total Years with Risk	Percent of Record	Average Days with Risk
24 NLP	13	38	69
24 NLP/D	10	29	69
15 CAN/D	19	56	44
7 DSL	33	97	36
NO PRJ	33	97	52
NATL	0	0	0

[1] Based on simulated flows from 1958 to 1991 and application of criteria developed by D. W. Kelley and Associates (Dettman and Kelley, 1986).

Source: MPWMD

Mitigation Measure 8.3.1-6

The District would mitigate the impacts on fall migrants by: 1) releasing sufficient flows from the dams as part of it's operating permit from the SWRCB; and 2) continuing the program for trapping and holding fall migrants, which is part of the Water Allocation Program five-year mitigation program, in years when sufficient flow cannot be released. Operating costs for the trapping and holding facilities would average $36,000 per year and range from $0 to $234,000 annually (Table 8-16). The impact on fall/winter migrants would be fully mitigated to a less than significant level as compared to natural conditions, and to a beneficial level as compared to the No Project.

Flows for Spring Emigration

Impact 8.3.1-7

Compared to simulated natural conditions overall, the 24 NLP would maintain similar opportunities for smolt emigration. It would slightly reduce the percentage of years with poor, critical or zero emigration conditions and reduce the number of years with a risk of stranding. But it would adversely impact opportunities for emigration in several critical-dry years.

Compared to simulated natural flows, the operation of 24,000 AF New Los Padres Reservoir would maintain similar opportunities for smolt emigration during below normal, above normal and wet years. It would slightly reduce the percentage of years with poor, critical or zero ratings from 9 percent to 8 percent, but would increase years with zero ratings from none to five (Table 8-17). It would reduce the percentage of years with excellent ratings by increasing the percentage of good years.

Compared to simulated natural conditions, the 24 NLP would reduce the occurrence of smolts being isolated by low flows during April and May, but the severity of risk would be increased once it occurred. The incidence of risk would decline from 26 percent to 15 percent of the record, but the number of days with risk would increase from an average of 20 to 56 days per year (Table 8-18). With the 24 NLP, the risk to smolts would be high only during certain critical years; there would be no risk in any other year type. The number of days with high risk in critical years would range from 36 to 61 days per year, or 59 to 100 percent of the April-May emigration period.

It should be noted that on an annual basis, the 24 NLP (and the 24 NLP/D) would provide substantially more protection against risk of isolation than other alternatives, including the No Project.

TABLE 8-16

SUMMARY OF ESTIMATED ANNUAL OPERATION COSTS
FOR MITIGATING IMPACTS ON FALL/WINTER DOWNSTREAM MIGRATION
OF JUVENILE STEELHEAD IN THE LOWER CARMEL RIVER
WITH ALTERNATIVE WATER SUPPLY PROJECTS

		Annual Operation Costs[2]		
Alternative	Initial Cost[1]	Average	Minimum	Maximum
24 NLP	$0	$36,000	$0	$234,000
24 NLP/D	0	28,000	0	239,000
15 CAN/D	0	42,000	0	161,000
7 DSL	0	58,000	0	179,000
NO PRJ	0	64,000	0	179,000

1 Facilities will be constructed as part of District's mitigation program for Allocation EIR.
2 Based on MPWMD CVSIM during period from 1958 to 1991.

Source: MPWMD

TABLE 8-17

RATINGS OF APRIL-MAY SMOLT EMIGRATION FLOWS INTO THE CARMEL RIVER LAGOON[1]

Alternative	Number of Years with Rating: Excel	Good	Fair	Poor	Crit	Zero	Percentage of 90 Simulated Years With a Poor, Critical or Zero
24 NLP	27	40	16	1	1	5	8
24 NLP/D	27	40	16	2	0	5	8
15 CAN/D	20	23	24	7	10	6	26
7 DSL	28	20	16	7	13	6	29
NO PRJ	30	18	15	6	13	8	30
NATL	40	27	15	5	3	0	9

[1] Based on simulated flows in the 1902-1991 period and the following criteria from Dettman and Kelley (1987): Excellent, flow >= 100 cfs; Good, flow 40 - 99 cfs; Fair, flow 20-39 cfs; Poor, flow 10-19 cfs; Critical, flow 0.1 < 10 cfs; Zero, flow < 0.1 cfs.

Source: MPWMD

TABLE 8-18

NUMBER OF DAYS DURING APRIL AND MAY THAT STEELHEAD SMOLTS ARE AT CRITICAL RISK OF ISOLATION IN THE REACH FROM THE LAGOON TO ROBLES DEL RIO[1]

Alternative	Number of Years with Risk	Percent of Record	Average Number of Days with Risk
24 NLP	5	15%	56
24 NLP/D	5	15%	61
15 CAN/D	20	59%	35
7 DSL	22	65%	39
NO PRJ	22	65%	40
NATL	9	26%	20

[1] Based on flows simulated by CVISM from 1958 to 1991 and application of criteria developed by D. W. Kelley and Associates (Dettman and Kelley, 1986).

Source: MPWMD

Mitigation Measure 8.3.1-7

In the infrequent critically dry years when emigration is affected, the District would mitigate impacts on spring emigrants by continuing the existing Water Allocation Program for trapping, holding, transporting and acclimating smolt emigrants when flows are insufficient for emigration. Operating costs would average $13,000 per year and range from $0 to $94,000 annually (Table 8-19). Impacts to spring migrants in critical years with risk would be mitigated, but some adverse impact would remain due to the stress of trapping and handling the smolts. The overall impact would therefore result in no impact.

IMPACTS ON FISH PASSAGE (24 NLP)

Before discussing impacts and mitigation measures of the 24 NLP alternative on fish passage, the following paragraphs describe the fish passage facilities that would be associated with the 24 NLP and 24 NLP/D alternatives. Each includes new passage facilities for upstream and downstream steelhead migration.

Upstream Passage Facility

Background. In 1983 the District retained several consultants to examine several alternatives for passing adults upstream at the site of New San Clemente Dam. They evaluated the cost, reliability and biological effects of five alternatives:

1) a lock that would move fish into the reservoir much as boats are locked around falls and rapids of large rivers;

2) a fish elevator to lift fish up the downstream side of the dam and a hopper to lower them down into the reservoir;

3) a fish ladder designed so that adults could climb over the dam into the reservoir every year;

4) a trapping and trucking operation to move the adults around the dam every year; and

5) a fish ladder designed to be used only in years when the reservoir was nearly full, combined with a trapping and trucking operation to be used when the reservoir was not full.

On the basis of their analysis, the consultants concluded that (1) there is no significant biological advantage to the alternatives that require construction of a long fish ladder at a cost of about $4.5 million; and (2) a well-designed trapping and trucking operation is the best way of moving adult

TABLE 8-19

SUMMARY OF ESTIMATED ANNUAL OPERATION COSTS FOR MITIGATING IMPACTS ON SPRING DOWNSTREAM EMIGRATION OF STEELHEAD SMOLTS IN THE LOWER CARMEL RIVER WITH ALTERNATIVE WATER SUPPLY PROJECTS

Alternative	Initial Cost[1]	Annual Operation Costs[2] Average	Minimum	Maximum
24 NLP	$0	$13,000	$0	$94,000
24 NLP/D	0	14,000	0	94,000
15 CAN/D	0	34,000	0	94,000
7 DSL	0	41,000	0	94,000
NO PRJ	0	42,000	0	94,000

[1]Facilities will be constructed as part of District's mitigation program for Allocation EIR.
[2]Based on MPWMD CVSIM during period from 1958 to 1991.

Source: MPWMD

steelhead upstream around New San Clemente Dam.[26] This evaluation applied to construction and operation of a 29,000 AF reservoir, and the conclusions would apply to any large reservoir on the mainstem of the Carmel River (except that costs would vary).

Facility Plan and Operation. In 1988, MPWMD contracted with Bechtel Civil to design the proposed upstream passage facility. The following description is from Bechtel's conceptual design report.[27]

The proposed site of the facility is about 400 feet downstream of the stilling basin lip of the proposed New Los Padres Dam. The facility will provide for collecting, limited holding, and hauling of adult upstream migrants to the reservoir impounded by the proposed new dam.

The facility consists of a fish barrier structure with a stilling basin, a water intake structure, a short fish ladder with entrance pool and fish collection pool weir box, the mechanical equipment needed for a trap and haul operation, and an electrical system for operation of the facility.

The barrier dam will be a concrete structure spanning the present river channel and designed to prevent the upstream passage of adult fish beyond it (Figure 8-12). A screened intake structure will draw water from the pool upstream of the barrier dam and direct it through diffusers to the head of the fish ladder and to the entrance pool. Attraction water flow will lead the fish into the entrance pool at the base of the fish ladder, which they would climb to reach the holding pool before being loaded into a tank truck for haulage to the reservoir upstream of the main dam.

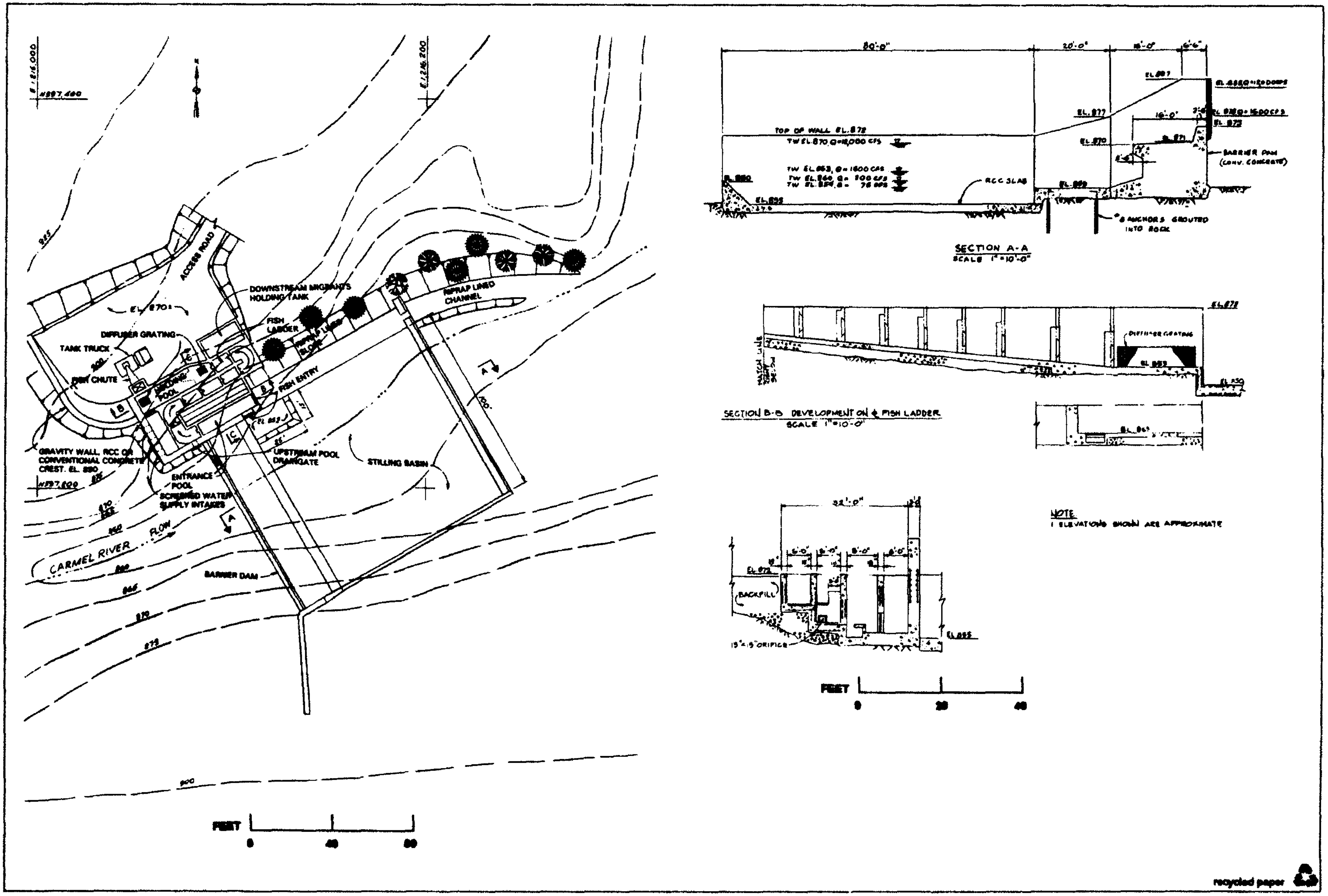
The new barrier dam, ladder, holding pond, and transport facility for adults is expected to solve all of the potential problems associated with the existing facility at the base of Los Padres Dam. This expectation will be tested by monitoring movements and behavior of adult steelhead below the barrier dam and in the upstream facility, and by counting the number of adults which migrate upstream and downstream past the facility at the head of the reservoir.

Downstream Passage Facility

Background. The track record of passing juvenile anadromous fish downstream through reservoirs and past dams is poor. A number of factors have been identified that reduce the survival of migrating juvenile salmonids. They include physical damage, increased stress in the facility, increased delay

PROPOSED UPSTREAM FISH COLLECTION FACILITIES, NEW LOS PADRES DAM, PLAN AND SECTIONS

FIGURE 8-12



SOURCE: BECHTEL CORP.

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during emigration, increased predation while passing through reservoirs, and inability to find an emigration route through reservoirs.

In the 1987 Draft EIR/EIS, the District had proposed a downstream passage facility that consisted of an attraction and collection device mounted on the upstream face of the dam, which would follow the fluctuations in reservoir elevation. The fish collected in the facility would have been transported to the river below the dam. This system was designed to minimize physical damage and stress, but even with the best design and operation, the potential for delay and high predation (while fish swam through the reservoir) still existed. Because of these problems, the State and federal agencies asserted that the fish horn concept was unacceptable, and that another alternative should be developed.

In 1988 the District retained Bechtel Civil to develop another conceptual design to avoid problems created by passing emigrating juveniles through a new reservoir. Following several meetings with State and federal fishery agencies and the Environmental Protection Agency, the concept for a screening facility and a trap-and-haul operation was developed that would avoid the unknown impacts of passing fish through the reservoir. This facility would screen migrating juveniles and post-spawning adults from the river and separate the groups for transportation to a release point downstream of the dam.

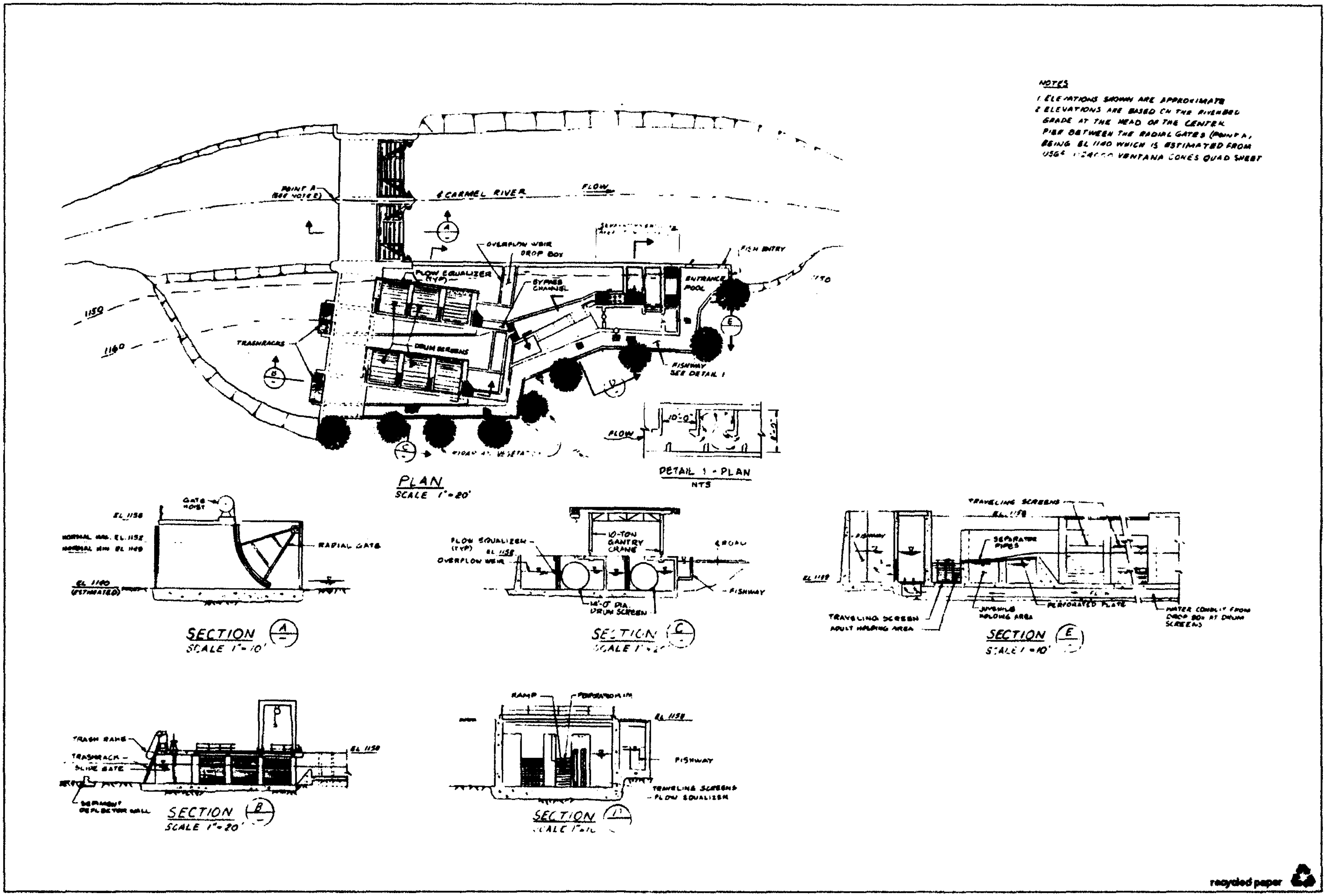
Facility Plan and Operation. The following description of the downstream migrant facilities is based on Bechtel's conceptual design report.[28]

The proposed site is located approximately 1,200 feet upstream of the upstream terminus of the new reservoirs. The facilities consist of a radial-gated seasonal dam, primary rotary drum fish screens, bypass channels, secondary fish screens, a fish separator, and holding tanks (Figure 8-13).

Water level controls will maintain the water level in the forebay behind the radial-gated dam within a range of about 3 feet. The first bay of drum screens would be operated at low flows. At higher flows and water surface elevations, water would be directed through the second forebay. Approximately 80 percent of the inflow will return to the river via a drop box, or as part of the attraction water for the upstream fish ladder provided for adults migrating upstream past the facility.

PROPOSED DOWNSTREAM FISH SCREENING FACILITIES, NEW LOS PADRES DAM, PLAN AND SECTIONS

FIGURE 8-13



SOURCE: BECHTEL CORP.

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The remaining flow and fish would enter bypass channels leading to the secondary screens and fish separator. There, the fish will be separated into two groups and discharged into two holding tanks. Trucks would then transport and release fish (depending on river conditions) into the river downstream from the main dam, the juvenile rearing area, the holding facility near Schulte Road, or the acclimation facility in the Lagoon.

The new fish screens, holding pond, and transport trucks will improve conditions for downstream emigration of steelhead smolts at New Los Padres Reservoir by reducing abrasion and injury of smolts which now causes significant mortality. The impact of trapping and transporting will be tested by monitoring the behavior of smolts in the facility, measuring stress levels of emigrating smolts, and measuring the overall survival of smolts between the time of emigration to their return as adults.

Remedial Action Plan

In consultation with State and Federal agencies, the District will develop a formal Remedial Action Plan to address problems that could possibly occur with the downstream or upstream passage facilities. The Plan would entail performance standards for the facilities, and a protocol to address the situation where performance standards are not being met. The emphasis would be on a procedure to address possible problems that could occur with the operation and maintenance of the downstream or upstream passage facilities. Specific solutions would depend on the nature and extent of the problems that may be observed. The District would set aside a contingency fund for passage facility improvements as an integral element of the project financing package, and would include a line item for monitoring facility performance in the annual O&M budget for the project.

If monitoring of behavior and measurements of mortality indicate that the facilities are causing low survival, every reasonable effort will be made to rectify the cause. If it is not technically possible to solve the problem which is causing low survival, the District proposes several options for improving performance, including:

1) extend the operating season into January and February to increase the duration of the normal operation season. This would increase the number of emigrants that would be trapped and transported.
2) Increase the number of rotary drum screens at the site to increase the magnitude of flows which could be effectively screened, thereby increasing the effectiveness of the screens.

3) Construct a passage facility on the upstream face of the reservoir to screen emigrants from reservoir spill and pass them safely downstream, through a specially designed, accessory spillway, a steep ladder, or flume.
4) If experiments indicate the trapping and transportation phases of the operation are causing significant mortality the District would consider construction of a flume or pipe to carry downstream emigrants from the fish screens to a steep ladder below the dam.
5) As a last resort the District would consider construction of a small hatchery mitigate the losses. The District understands that CDFG policy discourages the use hatcheries to mitigate for reservoir construction. The District does not favor this option because of the intrinsic values of a wild, natural run of steelhead; the cost to construct and operate a hatchery to mitigate for the loss of steelhead resource would be expensive; and it may not be practicable to operate a hatchery during all years. However, it is the District's understanding that if passage facilities completely failed, the California Fish and Game Commission would probably require the District to construct a mitigation hatchery.

Impact 8.3.1-8

Construction and operation of the proposed upstream and downstream migration facilities at the 24,000 AF New Los Padres Reservoir would provide good to excellent conditions for adults migrating upstream and for juveniles and adults emigrating downstream from the upper Carmel River to the ocean. The proposed design and operation of the downstream fish facility will result in the loss of 4 to 7 percent of the emigrating smolts. These impacts are considered beneficial compared to existing conditions because of the poor survival under existing conditions, but would produce an avoidable, adverse impact as compared to natural conditions.

Upstream Passage at New Los Padres Dam. The District would construct and operate the proposed upstream migration facility at New Los Padres Dam as part of the project. The capital cost for this facility is $2.8 million, and operation and maintenance costs total $39,000 annually.

This facility would provide excellent conditions for the collection and transport of adult steelhead, could substantially reduce the time required for upstream migration, would replace a substandard barrier dam and collection facility with state-of-the art technology, and could significantly improve opportunities for successful upstream migration.

These changes represent beneficial impacts compared to the existing situation and should produce less than significant impacts, as compared to natural conditions. With proper operations, a small risk exists that adult steelhead would be injured in the facility.

Downstream Passage at New Los Padres Dam. The District would construct and operate the proposed downstream migration facility at New Los Padres Dam as part of the project. The capital cost for this facility is $11.9 million, and operation and maintenance costs total $383,000 per year.

Downstream migrants would be screened, collected, and transported without delay at New Los Padres Dam (Table 8-20). A review of simulated flows indicates that the facility at the head of New Los Padres Reservoir could effectively screen all downstream emigrants in all April-May migrants in below normal years, dry and critical years. It would operate 60 to 68 percent of the time during the October to March period, and 96 to 99 percent of the time in April and May in above normal years (Table 8-21).

The downstream facility is designed to screen emigrants up to flows of 450 cfs and to operate ten months per year. Because of these features and the lack of passage facilities to safely carry emigrants over the new dam, the emigrants which are not screened will pass into the reservoir. These emigrants will probably not survive, when and if they pass over the spillway at the new dam. The estimated losses range from 4 to 7 percent of the total annual emigration (Table 8-22). Compared to the existing loss of about 20 percent, a loss of 4 to 7 percent indicates that the project will result in significant beneficial impacts. However, compared to natural conditions these losses represent a significant negative impact.

Downstream Passage at San Clemente Dam. Migrants at San Clemente Dam would use the existing spillway or fish ladder, but migration would be delayed approximately two weeks because San Clemente Reservoir would not always remain full throughout the fall-winter period (Table 8-23). This would represent an improvement over the No Project operation, which indicates that the fall-winter steelhead migration would be delayed an average of 27 days per year (Table 8-23). During

Mitigation Measure 8.3.1-8

No further mitigation is necessary for upstream migrants. If monitoring indicates the losses of downstream migrants exceeds 5 percent, the District will consider adding more rotary screens and extending the seasonal operation to increase the effectiveness of the fish screens. If these

TABLE 8-20

INDEX OF MIGRATION DELAYS AT LOS PADRES AND SAN CLEMENTE DAMS DURING THE OCTOBER THROUGH MARCH PERIOD WITH ALTERNATIVE WATER SUPPLY PROJECTS[1]

	Index of Migration Delay (Days)	
	Los Padres[2]	San Clemente[3]
24 NLP	0	17
24 NLP/D	0	16
15 CAN/D	18	24
7 DSL	19	25
NO PRJ	15	27
NATL	0	0

[1] Index based on the average number of days between date of first downstream migration of juvenile steelhead and first date of consistent passage conditions at the dam. Based on simulated flows and elevations at San Clemente and Los Padres Dams from MPWMD, CVSIM during period from 1958 to 1991.

[2] Index based on the number of days between the date of first downstream migration of juvenile steelhead and first date that juvenile steelhead can migrate past Los Padres and on simulated inflows and storage volumes at Los Padres (CVSIM dated 2 October 92 for water supply projects, 7 May 92 for No Project, and 23 November 91 for unimpaired, natural condition. For No Project the date of first passage occurs when reservoir is spilling at elevation 1,040. For New Los Padres the date of first passage always begins with the first movement of fish, because the downstream passage facility always operates on October 1.

[3] Passage without delay occurs when reservoir is spilling at elevation 525 ft. with flashboards installed, and when no interruption in these conditions occurs during the October through March period.

Source: MPWMD

TABLE 8-21

AVERAGE PERCENTAGE OF DAYS THAT PROPOSED FISH PASSAGE FACILITIES AT NEW LOS PADRES RESERVOIR WOULD EFFECTIVELY OPERATE DURING PERIODS FROM OCTOBER THROUGH MARCH AND APRIL THROUGH SEPTEMBER OF WET, ABOVE NORMAL, BELOW NORMAL, DRY AND CRITICAL YEARS[1]

	October Through March (%)					April Through September (%)				
Alternative	Wet	Above Normal	Below Normal	Dry	Critical	Wet	Above Normal	Below Normal	Dry	Critical
24 NLP	60	64	67	67	68	96	99	100	100	100
24 NLP/D	60	64	67	67	68	96	99	100	100	100

[1]Based on simulated inflows at Los Padres Reservoir during period from 1958 to 1991, and on proposed design flows for new facilities

Source: MPWMD

TABLE 8-22

EXPECTED LOSSES OF JUVENILE STEELHEAD IN NEW LOS PADRES RESERVOIR AND THE PERCENTAGE OF THE TOTAL POPULATION OF EMIGRATING JUVENILE STEELHEAD THAT ARE BYPASSED INTO NEW LOS PADRES RESERVOIR

Water Year Type	Losses of Juvenile[1] Steelhead (number of fish)	Percentage of Total Annual Emigration
Wet	6,500	7
Above Normal	4,700	5
Below Normal	3,800	4
Dry	3,800	4
Critical	3,700	4

[1] Estimate of losses based on assumptions: 1) habitat upstream of New Los Padres Reservoir is fully seeded with juvenile steelhead; 2) the pattern of seasonal downstream migration into Los Padres Reservoir is similar to historical patterns in Waddell Creek, Santa Cruz Co.; 3) late-summer/early-fall juvenile population is comprised of 86% age 0+, 11% age 1+, 2% age 2+, and 1% age 3+ fish; 4) fish passage facility operates up to flows of 450 cfs; 5) the facility shuts down for annual maintenance during January and February; and 6) daily inflow Los Padres Reservoir are from MPWMD reconstructed historical record during period from 1902 to 1991.

Source: MPWMD

TABLE 8-23

AVERAGE PERCENTAGE OF DAYS THAT SAN CLEMENTE DAM IS SPILLING DURING OCTOBER THROUGH MARCH AND APRIL THROUGH MAY OF WET, ABOVE NORMAL, BELOW NORMAL, DRY AND CRITICAL YEARS WITH WATER SUPPLY ALTERNATIVES AND NATURAL RUNOFF[1]

	October Through March					April Through May				
Alternative	Wet	Above Normal	Below Normal	Dry	Critical	Wet	Above Normal	Below Normal	Dry	Critical
24 NLP	90	86	100	78	53	100	100	100	100	44
24 NLP/D	91	86	100	83	61	100	100	100	100	40
15 CAN/D	66	72	65	53	38	100	94	82	76	29
7 DSL	65	70	65	53	42	100	94	82	70	32
NO PRJ	65	70	65	53	43	94	94	84	73	16
NATL	100	100	100	100	100	100	100	100	100	100

1 Based on simulation of inflows and storage volume at San Clemente Reservoir during period from 1958 to 1991. CVSIM dated 7 May 1992 for No Project, 2 October 1992 for other alternatives, and 7 November 1991 for natural condition.

Source: MPWMD

mitigations were implemented, the effectiveness of the screens would be increased to the point where losses would be insignificant compared to natural conditions. To solve the problem of delaying fall-winter and spring emigrants at San Clemente Dam, the District would release sufficient volumes to keep San Clemente Reservoir full at all times, except in the most severe drought.

CONSEQUENCE OF FAILING TO SUCCESSFULLY PASS STEELHEAD

State and Federal agencies have requested information on the consequences of the failure of fish passage facilities, and would require mitigation for the loss of the run upstream of the passage facilities.

A failure to pass fish with the New Los Padres Reservoir projects would result in a loss of about 100 fish, which is the historical average adult return at Los Padres Reservoir from 1980 to 1990. However, the state and federal resource agencies would probably require the District to offset losses based on the "potential" run. Estimates of the potential run range from about 1,300 to 1,800 adults.[29] Mitigation would probably involve construction of a hatchery, which would be operated to maximize the preservation of the Carmel River steelhead gene pool. A hatchery would be considered as a last resort for the reasons enumerated above (see "Remedial Action Plan").

PROJECT IMPACTS ON WATER TEMPERATURE

Impact 8.3.1-9

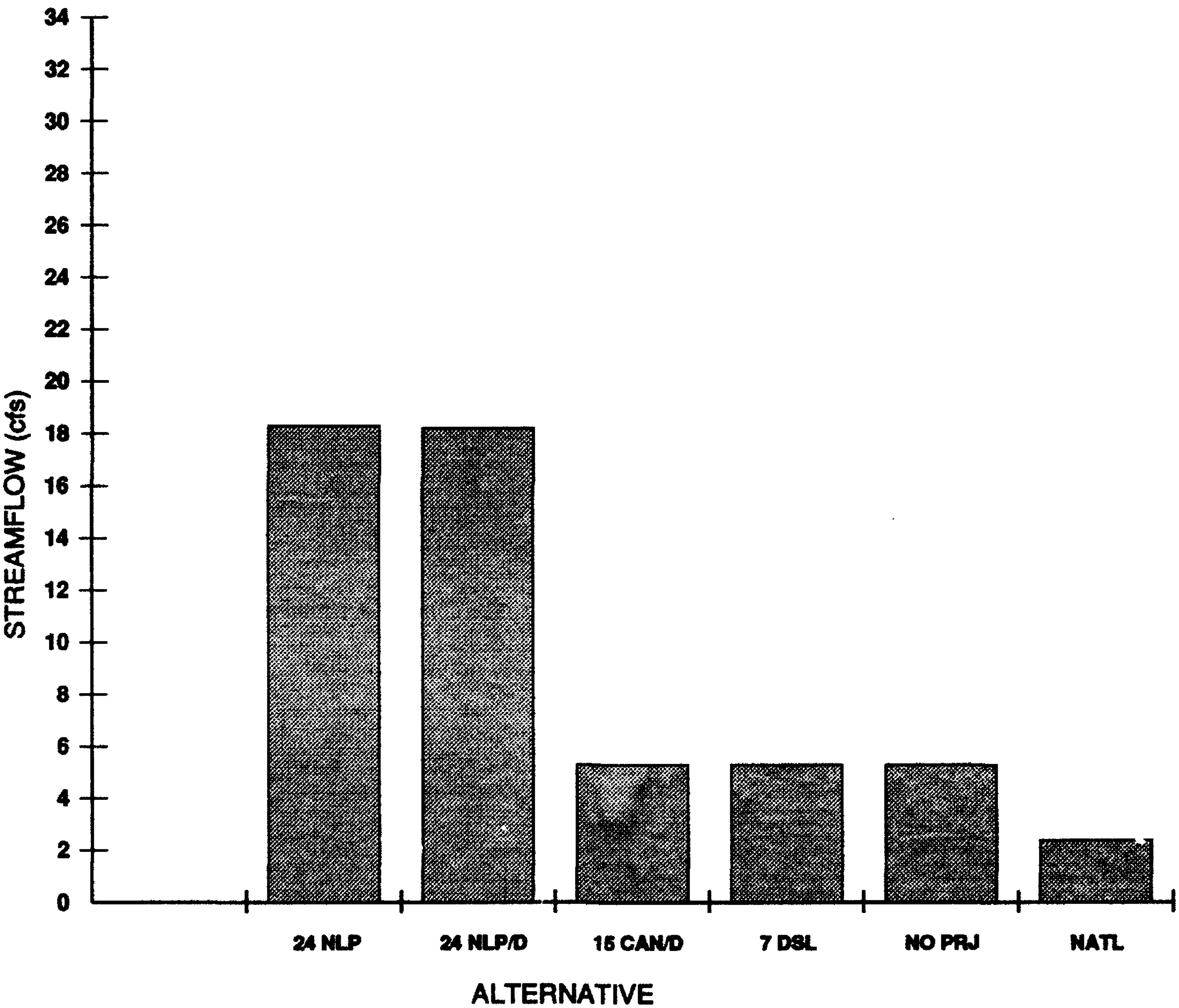
The 24 NLP would have a beneficial impact on summer water temperatures in dry years, and critical years.

With this alternative, average summer streamflow releases of 18 cfs would be made into the mainstem Carmel River below Los Padres Dam (Figure 8-14). Because augmented flows would be about eight times the natural and four times the No Project flows, water temperature of the release would influence the mainstem for a longer distance downstream of the new dam.

Hypolimnetic Volume at Beginning of Summer. With 24 NLP, an average of about 9,400 AF of cool hypolimnetic water would be available for release at the beginning of the dry season. In two years of the historical record, no cool water would be available (Table 8-24). This alternative would provide the most cool water of any project at the beginning of the dry season, except 24 NLP/D, and represents a significant beneficial impact.

AVERAGE MINIMUM MEAN MONTHLY FLOWS BELOW LOS PADRES DAM DURING THE LATE SUMMER-EARLY FALL SEASON WITH ALTERNATIVE WATER SUPPLY PROJECTS

FIGURE 8-14



SOURCE: MPWMD

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TABLE 8-24

SIMULATED VOLUME OF HYPOLIMNETIC STORAGE ON JUNE 1 (ACRE-FEET)[1]

Alternative	Average	Years with Zero Storage[2]
24 NLP	9,428	2
24 NLP/D	9,978	1
15 CAN/D	486	0
7 DSL	486	0
NO PRJ	486	0

[1] Simulated volume of water in hypolimnetic storage beginning June 1 with alternative water supply projects. Based on simulated storage volumes and elevations in main storage reservoir with each alternative water supply project and assumption that depth of epilimnion is 30 feet on June 1 during the period from 1958 to 1991.

[2] Number of years out of 34 total years in the simulation.

Source: MPWMD

Hypolimnetic Volume at End of Dry Season. With 24 NLP, an average of 3,600 AF of cool hypolimnetic water would be available for release at the end dry season. Cool water would be exhausted in seven years of the historical record (Table 8-25). These would be beneficial impacts as compared to the No Project.

Days with Hypolimnetic Releases. On average, the 24 NLP, would provide cool water releases throughout the dry season of wet and above normal years. It would maintain cool water releases thru 88 percent of the dry season in below normal years, 64 percent in dry years, and 54 percent in critical years (Table 8-26). These would be beneficial impacts as compared to the No Project during dry and critical years.

Mitigation Measure 8.3.1-9

The conceptual design of 24 NLP includes a multiple level intake structure on the outlet works. If it is selected as the preferred alternative, the District would conduct operation studies and water temperature simulations to provide a detailed set of operation rules for managing releases in such a way as to conserve cool water during the dry season and provide optimum water temperatures for spawning and egg incubation. With careful operations, the 24 NLP would have a beneficial impact on summer water temperatures in all years.

SUMMARY OF 24 NLP IMPACTS TO STEELHEAD RESOURCE

Habitat Inundation. The 24 NLP would inundate or block 12 percent of spawning habitat and 12 to 14 percent of rearing habitat for steelhead in the Carmel Basin. Both effects are considered as significant adverse impacts. Impacts to spawning habitat could be mitigated to a less than significant level through the spawning habitat restoration program described in Appendix 8. Impacts to rearing habitat would be mitigated to a beneficial level by releasing flow from the new reservoir that significantly improves rearing habitat below the dam. Overall, spawning habitat would increase by 36 percent and rearing habitat would increase by 67 percent, as compared to the No Project conditions.

Operation Impacts on Steelhead Life Cycle. Compared to simulated natural conditions, the flow patterns resulting from the 24 NLP would significantly reduce opportunities for upstream migration, but would improve conditions, as compared to the No Project alternative. Additional mitigations such as holding a contingent of spawners at Granite Canyon Marine Laboratory or artificially attracting

TABLE 8-25

HYPOLIMNETIC VOLUME (ACRE-FEET) AT END OF DRY SEASON[1]

Alternative	Average	Years with Zero Storage[2]
24 NLP	3,622	7
24 NLP/D	4,409	6
15 CAN/D	263	11
7 DSL	261	11
NO PRJ	261	11

[1] Simulated volume of water in hypolimnetic storage ending october 31 with alternative water supply projects. Based on simulated storage volumes and elevations in main storage reservoir with each alternative water supply project and assumption that depth of epilimnion is 30 feet on June 1 during the period from 1958 to 1991.

[2] Number of years out of 34 total years in the simulation.

Source: MPWMD

TABLE 8-26

SIMULATED NUMBER OF DAYS THAT HYPOLIMNETIC WATER COULD BE RELEASED BELOW LOS PADRES RESERVOIR WITH ALTERNATIVE WATER SUPPLY PROJECTS

	Average Number of Days With Hypolimnetic Releases					Percentage of Period With Hypolimnetic Releases				
Alternative	Wet	Above Normal	Below Normal	Dry	Critical	Wet	Above Normal	Below Normal	Dry	Critical
24 NLP	153	153	134	98	83	100	100	88	64	54
24 NLP/D	153	153	145	104	104	100	100	94	68	68
15 CAN/D	153	147	134	81	75	100	96	88	53	49
7 DSL	153	147	135	82	67	100	96	88	54	44
NO PRJ	153	147	135	78	67	100	96	88	54	44

[1] Stratified by type of water year during the period from 1958 to 1991. Based on simulated storage volumes and elevations in storage reservoir (MPWMD, CVSIM) and assumption that depth of epilimnion is 30 feet on June 1. Simulations for Cañada, 7 MGD Desalination, and No Project refer to releases from existing Los Padres Reservoir. New Los Padres alternatives simulations refer to releases below New Los Padres Dam.

Source: MPWMD

sea-run adult steelhead are suggested. The mitigated impact is considered to be significant and potentially unavoidable.

Compared to simulated natural conditions, the 24 NLP impact on spawning habitat would be beneficial overall. The new operation schedule for 24 NLP, which establishes minimum flow standards below the new dam and at the Narrows during the winter spawning season, and the spawning habitat mitigation plan will fully compensate for the adverse inundation impacts of 24 NLP reservoir. The mitigated impact is considered to be a significant beneficial impact.

Compared to natural conditions, the 24 NLP would beneficially affect juvenile rearing habitat and spring emigration of smolts; no additional mitigation measures would be required. Flows for fall-winter downstream migration would be considered beneficial compared to the existing situation, but adverse compared to simulated natural flows. This dichotomy reflects the degraded situation that presently exists in the Carmel River. The significant adverse effect can be mitigated to a less than significant level by flow releases and the continuation of a trapping program that is part of the Water Allocation Mitigation Program (See Appendix 2-C).

Fish Passage Compared to the existing conditions, the small losses of 4 to 7 percent of emigrants at New Los Padres Reservoir would result in a beneficial impact. But compared to natural conditions these losses represent a significant negative impact. State-of-the-art facilities would replace inadequate facilities at Los Padres Dam, and increased flows would improve passage over San Clemente Dam. If returns of adults to Los Padres Dam do not increase and the problem is related to the design and operation of the downstream passage facility, additional mitigation may be required.

Water Temperature The longer duration of cool-water releases would result in beneficial effects to Carmel River water temperature in dry and critically dry years. With careful operations and the multiple level outlet, the water temperatures below New Los Padres dam would be suitable for all life history phases of steelhead.

8.3.2 24,000 AF NEW LOS PADRES RESERVOIR WITH 3 MGD DESALINATION PLANT (24 NLP/D)

INUNDATION AND BLOCKAGE OF SPAWNING HABITAT

Impact 8.3.2-1

The 24 NLP/D alternative would inundate or block the same amount of habitat as the 24 NLP without the desalination component. This represents a significant adverse impact.

Construction of the 24 NLP/D alternative would inundate or block a total of 3.4 miles of stream, including 2.1 miles of the Carmel River or Danish Creek and block 1.3 miles of Danish Creek (Table 8-2). The overall impact would reduce spawning habitat by 10,900 square feet, equivalent to a potential 216 nest sites.

Mitigation Measure 8.3.2-1

Spawning habitat would be restored by the methods described under Mitigation Measure 8.3.1-1. Initially, 538 cubic yards of gravel would be added to spawning glides between Sleepy Hollow and New Los Padres Dam. The estimated capital cost would total $176,000 with $23,300 annually for operations (Table 8-3). Implementation of this program would fully mitigate inundation impacts to a less than significant level.

INUNDATION AND BLOCKAGE OF REARING HABITAT

Impact 8.3.2-2

The 24 NLP/D alternative would inundate or block the same amount of rearing habitat as the 24 NLP without the desalination component. This would result in a significant adverse impact.

Construction of a 24,000 AF New Los Padres with desalination would affect rearing habitat and would inundate or block a total of 3.4 miles on the Carmel River and Danish Creek. About 1.5 million Rearing Units (RU) for age 0+ steelhead and 0.8 million units for yearlings would be lost (Table 8-4).

Mitigation Measure 8.3.2-2

This impact can be fully mitigated by releasing flows into the Carmel River below New Los Padres Dam and existing San Clemente Dam as part of the normal reservoir operation schedule. As with 24 NLP alternative, a substantial improvement in streamflow would be gained by this mitigation, which would result in a beneficial impact on rearing habitat.

The proposed operation of 24 NLP/D would increase age 0+ juvenile habitat by 3.4 million RI units over the natural condition, or almost thrice the 1.3 million units of rearing habitat inundated by the project (Table 8-5). This project would enhance rearing habitat for juvenile steelhead.

IMPACTS OF PROJECT OPERATION

Flows For Adult Upstream Migration

Impact 8.3.2-3

As compared to natural flow conditions, the operation of 24 NLP/D would impact opportunities for upstream migration by limiting the duration of attraction flows, shortening the duration of the migration season in dry and critical years, and increasing the number of years without attraction flows. However, as compared to the No Project the 24 NLP/D would significantly improve conditions and its performance is better than the stand-alone 24 NLP.

At buildout demand levels, the 24 NLP/D would meet modified CDFG seasonal criteria in 66 percent of the years and would achieve a fair or better rating with the DWK monthly criteria in 43 percent, 70 percent, and 77 percent of the Januaries, Februaries, and Marches, respectively (Table 8-6). As compared to natural flows, the operation of 24 NLP/D would adversely impact upstream migration by reducing the percentage of years with flows exceeding CDFG criteria and by reducing opportunities for upstream migration during January, February, and March.

On average, the 24 NLP/D would provide 26 days of attraction flows (minimum 200, 100, or 75 cfs, depending on year type), and would meet the modified CDFG criteria of at least 18 days of attraction flows during wet, above normal, and some below normal years (Table 8-7). However, this alternative would fall short of the 18-day recommendation in dry and critical years; in 18 percent of the years no attraction flows would occur. Compared to natural conditions and most other alternatives, the 24 NLP/D would have the second best performance in terms of attraction flows.

On average, the duration of the migration season would be 51 days, which is only 3 days shorter than under natural conditions. Most of the impacts would occur in dry, and critical years, when the average duration would be reduced by 5 days during dry years and 8 days during critical years, compared to natural conditions (Table 8-8). Compared to the No Project and all other alternatives, the 24 NLP/D has the longest duration of migration season.

Mitigation Measure 8.3.2-3

The District suggests investigations of similar mitigations as for the 24 NLP alternative, including a captive broodstock program and a program to attract and transport sea-run adult steelhead during drought years. If these programs were implemented, then impacts on upstream migration would be reduced, but full mitigation would be unlikely. Thus, this impact is considered to be an unavoidable significant impact. It is important to note that these unmitigated impacts would only occur during severe drought conditions, such as the 1987-92 event.

Flows For Steelhead Spawning Habitat

Impact 8.3.2-4

Compared to natural conditions, the operation of 24 NLP/D would significantly increase spawning habitat between the Narrows and New Los Padres Dam. This is a significant beneficial impact.

Downstream of San Clemente Dam. In the reach between the Narrows and San Clemente Dam, the operation of 24 NLP would reduce average February flows at the Narrows by 59 cfs and March flows by 28 cfs. This flow reduction and the mitigation program for improving substrate conditions would provide a total of 18,300 units of WUA, which is a beneficial impact compared to the No Project and Natural flow conditions (Table 8-9).

Between San Clemente and Los Padres Dams. During the selected years, operation of 24 NLP/D would increase the average WUA form 8,100 to 13,500 units, or a 67 percent increase (Table 8-10). This is caused by streamflow reductions during some years, which increase spawning habitat, and by the addition of spawning gravels, which is part of the proposed spawning habitat mitigation program under Mitigation Measure 8.3.1-1.

The increase in spawning habitat between the Narrows and New Los Padres Dam would compensate for the loss of habitat inundated by the new reservoir. Thus, the 24 NLP/D would result in a significant beneficial impact.

Mitigation Measure 8.3.2-4

Same mitigation measures as described for 24 NLP. See Mitigation Measure 8.3.1-4.

Impact 8.3.2-5

Overall, the summer, fall and early winter flow releases from the 24 NLP/D would provide beneficial impacts to fry and juvenile steelhead by increasing habitat in the Carmel River, and would mitigate for inundation impacts from the reservoir (Table 8-5). Steelhead fry habitat in the reach between the dams would be maintained at the same level as with natural flows, and the seasonality of streamflow in the river below the Narrows would be reduced.

Near Carmel to the Narrows. Compared to natural flow conditions, the operation of 24 NLP/D would reduce the percentage of years when the lower river drys-up from 44 to 35 percent (Table 8-11). This would be a beneficial impact and is better performance than the stand-alone 24 NLP.

Narrows to San Clemente Dam. Compared to natural flows, the operation of 24 NLP/D would increase the average minimum summer flow at the Narrows from 3.2 to 11.2 cfs (Figure 8-10). The increased flow would provide 3.7 million rearing index units of age 0+ juvenile habitat in the reach between the Narrows and San Clemente Dam, or a 171 percent increase in habitat, as compared to the 1.4 million units with natural flows (Table 8-12). The project would increase habitat for yearling steelhead from 0.4 to 1.5 million units, which would be a beneficial impact.

Between San Clemente and Los Padres Dams. The operation of 24 NLP/D would increase the average minimum late spring and early summer flow below Los Padres from 20.1 to 31.2 cfs (Figure 8-11). This increased flow would reduce habitat for steelhead fry from an average 284,000 WUA to 281,000 units, or about one percent (Table 8-13). This impact would be less than significant.

The operation of 24 NLP/D would increase the average late summer flow below Los Padres from 2.4 to 18.2 cfs, which would increase habitat for juvenile steelhead from an average 62,000 WUA units to 295,000 units, or a 376 percent increase (Table 8-13). This would be a beneficial impact.

Mitigation Measure 8.3.2-5

No mitigation measures are required for operation impacts; however, to ensure that the inundated habitat is fully mitigated, the MPWMD may continue to rescue and rear juveniles with this alternative. The program would be needed during droughts and would operate an average of six months per year during those periods. Operation costs for this program would average $24,000 per year, and range from $0 to $97,000 per year (Table 8-14).

Flows For Fall-Winter Downstream Migration

Impact 8.3.2-6

Compared to simulated natural flows, the operation of 24 NLP/D would increase the risk that juvenile steelhead would be stranded in the Carmel River downstream of Robles del Rio, but would reduce this risk compared to the No Project and performs better than the 24 NLP alternative.

Simulated natural flows would never result in isolation or stranding. The 24 NLP/D alternative would result in significantly less years with risk than other alternatives. During the ten years (29 percent of simulated years) when a risk would occur, the number of days with high risk would average 69 days per year (Table 8-15). This would be a significant adverse impact, compared to natural conditions, but a beneficial impact, compared to the No Project because risk would occur every year with the No Project.

Mitigation Measures 8.3.2-6

Mitigation measures include releasing sufficient flow whenever possible, and continuing existing rescue and transport program when flows are insufficient. With 24 NLP/D the cost for continuing this program would average $28,000 per year and range from $0 to $239,000 per year (Table 8-16). These actions would fully mitigate impacts of stranding migrants in critical years to a less than significant level as compared to natural conditions, and to a beneficial level as compared to the No Project.

Flows for Spring Emigration

Impact 8.3.2-7

Impacts would be the same as described for 24 NLP under Mitigation Measure 8.3.1-7. Compared to simulated natural conditions, the 24 NLP alternative would maintain similar opportunities for smolt emigration. It would slightly reduce the percentage of years with poor, critical or zero emigration conditions and reduce the number of years with a risk of stranding. But it would adversely impact opportunities for emigration is several critically-dry years.

Compared to simulated natural flows, the operation of 24,000 AF New Los Padres Reservoir would maintain similar opportunities for smolt emigration during below normal, above normal, and wet years. It would slightly reduce the percentage of years with poor, critical or zero ratings from 9 percent to 8 percent, but would increase years with zero ratings from none to five (Table 8-17). It

would reduce the percentage of years with good to excellent ratings, but would increase the percentage of fair years.

Compared to simulated natural conditions, the 24 NLP would reduce the occurrence of smolts being isolated by low flows during April and May, but the severity of risk would be increased once it occurred. The incidence of risk would decline from 26 percent to 15 percent of the record, but the number of days with risk would increase from an average of 20 to 61 days per year (Table 8-18). With the 24 NLP, the risk to smolts would be high only during certain critical years; there would be no risk in any other year type. Whenever the risk occurred, it would last for the entire April-May emigration period.

Mitigation Measure 8.3.2-7

In the infrequent critically dry years when emigration is affected, the District would mitigate impacts on spring emigrants by continuing the existing Water Allocation Program for trapping, holding, transporting and acclimating smolt emigrants when flows are insufficient for emigration. Operating costs would average $14,000 per year and range from $0 to $94,000 annually (Table 8-19). Impacts to spring migrants in critical years with risk would be mitigated, but some adverse impact would remain due to the stress of trapping and handling the smolts. The overall impact would therefore result in no impact.

IMPACTS ON FISH PASSAGE

Impact 8.3.2-8

Construction and operation of the proposed upstream and downstream migration facilities at the 24 NLP/D would provide good to excellent conditions for adults migrating upstream and for juveniles and adults emigrating downstream from the upper Carmel River to the ocean. The proposed design and operation of the downstream fish facility will result in the loss of 4 to 7 percent of the emigrating smolts. These impacts are considered beneficial compared to existing conditions because of the poor survival under existing conditions, but would produce an avoidable, adverse impact as compared to natural conditions.

Upstream Passage at New Los Padres Dam. The 24 NLP/D would have the same impacts, mitigations and costs as the 24 NLP alternative.

Downstream Passage at New Los Padres Dam. The 24 NLP/D would have the same impacts and mitigations as the 24 NLP alternative.

Downstream Passage at San Clemente Dam. With a 24 NLP/D, the existing San Clemente Reservoir would not spill immediately following early fall-winter storms. This would delay the passage of migrating juvenile steelhead by an average of 16 days per year during late fall and early winter (Table 8-20). In critical years, smolts could emigrate 44 percent of the time during the April-May period, but would be blocked during the remainder of the period (Table 8-23). This impact is an improvement, compared to No Project conditions, but represents a significant adverse impact, compared to natural conditions.

Mitigation Measure 8.3.2-8

No further mitigation is necessary for upstream migrants. If monitoring indicates the losses of downstream migrants exceeds 5 percent, the District will consider adding more rotary screens and extending the seasonal operation to increase the effectiveness of the fish screens. If these mitigations were implemented, the effectiveness of the screens would be increased to the point where losses would be insignificant compared to natural conditions. To solve the problem of delaying fall-winter and spring emigrants at San Clemente Dam, the District would release sufficient volumes to keep San Clemente Reservoir full at all times, except in the most severe drought.

PROJECT IMPACTS ON WATER TEMPERATURE

Impact 8.3.2-9

Compared to the No Project, the 24 NLP would have a beneficial impact on summer water temperatures in dry and critically-dry years

With this alternative average minimum summer streamflow releases of 18 cfs would be made into the mainstem Carmel River below Los Padres Dam (Figure 8-14). Because augmented flows would be about eight times the natural and four times the No Project flows, water temperatures of the releases would influence the mainstem for a longer distance downstream of the new dam.

Hypolimnetic Volume at Beginning of Summer. With 24 NLP/D an average of about 10,000 acre-feet of cool hypolimnetic water would be available for release at the beginning of the dry season, and in one year of the historical record, no cool water would be available (Table 8-24). As compared to other alternatives, the 24 NLP/D provides the greatest volume of cool water at the beginning of the dry season, and represents a beneficial impact.

Hypolimnetic Volume at End of Dry Season. With 24 NLP/D an average of 4,400 acre-feet of cool, hypolimnetic water would be available for release at the end of the dry season, and cool water would be exhausted in only 16 years of the historical record (Table 8-25). These would be beneficial impacts as compared to the No Project.

Days with Hypolimnetic Releases. On average the 24 NLP/D would provide cool water releases throughout the dry season of wet and above normal years. It would maintain cool-water releases thru 88 percent of the dry season in below normal, and 68 percent of the summer during dry and critical years (Table 8-26). These would be beneficial impacts as compared to the No Project and the best performance of other alternatives.

Mitigation Measure 8.3.2-9

The conceptual design of the 24 NLP/D includes a multiple level intake structure on the outlet works. If 24 NLP is selected as a preferred alternative, the District would conduct operation studies and water temperature simulations to provide a detailed set of operation rules for managing releases in a way to conserve cool water during the dry season and provide optimum water temperatures for spawning and egg incubation. With careful operation the 24 NLP/D would have a beneficial impact on summer water temperatures is all years.

SUMMARY OF 24 NLP/D IMPACTS TO STEELHEAD RESOURCE

Impacts and mitigations for the 24 NLP/D would be the same as or similar to all those described for the 24 NLP in the Section above. The addition of a desalination component with this alternative improves performance for several portions of the lifecycle (upstream migration, lower risk of summer and late fall-early winter stranding of juveniles) and provides more flexibility in maintaining cool-water releases below Los Padres Dam.

8.3.3 15,000 AF CAÑADA RESERVOIR WITH 3 MGD DESALINATION PLANT (15 CAN/D)

INUNDATION AND BLOCKAGE OF SPAWNING HABITAT

Impact 8.3.3-1

The 15 CAN/D alternative would not inundate or block spawning habitat in the Carmel Basin.

Mitigation Measure 8.3.3-1

No mitigation measures would be required. However, the habitat losses that would occur due to diversion at San Clemente Dam with this alternative could be mitigated by restoring spawning habitat below the existing dams. If implemented, such a program would result in a beneficial impact as compared to the existing situation.

INUNDATION AND BLOCKAGE OF REARING HABITAT (15 CAN/D)

Impact 8.3.3-2

The 15 CAN/D alternative would not inundate or block rearing habitat in the Carmel Basin.

Mitigation Measure 8.3.3-2

No mitigation measures would be required. The project operations would result in increases in juvenile rearing habitat by 250,000 RI units, or a 13 percent increase over natural conditions. This would be a beneficial impact.

IMPACTS OF PROJECT OPERATION

Flows for Adult Upstream Migration

Impact 8.3.3-3

Overall, the operation of 15 CAN/D at buildout demand would significantly reduce opportunities for upstream migration by limiting the duration of attraction flows, shortening the duration of the migration season, and increasing the number of years without attraction flows. It would have the least impact of reservoir alternatives on attraction flows, but would fall short in maintaining adequate flows for transportation over critical riffles in the lower river below the diversion point.

At buildout demand levels, the 15,000 AF reservoir would meet modified CDFG seasonal criteria in 68 percent of the years and achieve a "fair" or better rating with the DWK monthly criteria in 50 percent, 71 percent, and 71 percent of the Januaries, Februaries, and Marches, respectively (Table 8-6). Compared to natural flows, the operation of 15 CAN/D would adversely impact upstream migration by reducing the percentage of years with flows exceeding CDFG criteria and by reducing opportunities for upstream migration during January, February, and March.

On average, the 15 CAN/D would provide 28 days of attraction flows (minimum flows ranging from 75 to 200 cfs, depending on year type and month), and would bypass an average of two weeks of attraction flows during dry, below normal, above normal and wet years (Table 8-7). The 15 CAN/D would fall short of attraction events primarily during critically-dry years; on average there would be only two days of attraction flows during critically-dry years. This represents a significant negative impact as compared to an average of 5 days under natural conditions, but is better than the No Project, which averages one day per year. Although this alternative would significantly reduce attraction flows, it would have the least overall impact of any alternative.

On average, the duration of the migration season would be 44 days, which is about 10 days shorter than under natural conditions and the shortest season of any alternative (Table 8-8). The impact would occur in all but the wet years. The average duration would be reduced by six days during above normal years, 21 days during below normal years, 12 days during dry years and 7 days during critical years.

Mitigation Measure 8.3.3-3

Same mitigation measures, as described for 24 NLP (see Mitigation Measure 8.3.1-3). In addition the operation of 15 CAN/D would probably require maintenance dredging of the river channel below the diversion point at river mile 5.4. If these mitigations were successful, this would remain an unavoidable significant impact because the Cañada project does not entail releases to the river.

Flows for Steelhead Spawning Habitat

Impact 8.3.3-4

The operation of 15 CAN/D would slightly increase spawning habitat between San Clemente Reservoir and Los Padres Dam and significantly reduce spawning habitat downstream of San Clemente Dam by maintaining high diversions through the Carmel Valley Filter Plant during February and March of below normal, dry and some critical years. Overall, this represent a significant, adverse impact.

Downstream of San Clemente Dam: The operation of the 15,000 AF Cañada Reservoir would reduce average February and March flows at the Narrows by 13 cfs. These flow reductions would provide 14,700 units of WUA, which a equivalent to No Project conditions, but represents a significant, adverse reduction of 5 percent compared to Natural conditions (Table 8-9).

Between San Clemente and Los Padres Dams: Table 8-10 lists the total weighted useable spawning habitat area (WUA) between the dams during 44 selected years of the simulated 89-year record. During the selected years, operation of 15 CAN/D would increase the average WUA from 8,100 to 8,200 units, a slight but significant beneficial impact.

Mitigation Measures 8.3.3-4

Operation of 15 CAN/D would reduce spawning habitat in the river upstream of the Narrows. The District would investigate whether flows could be improved by changing operations during February and March of below normal and dry years. If that is not sufficient, MPWMD would improve spawning habitat by implementing a program to maintain spawning gravels upstream of the Narrows. Thus, the adverse impact would be reduced to a less than significant level.

Flows for Juvenile Rearing Habitat

Impact 8.3.3-5

The 15 CAN/D alternative would result in increased steelhead fry and juvenile habitat in the reach between the dams, but would significantly reduce habitat in the reach between San Clemente Dam and the Near Carmel gage. Compared to Natural flows it would maintain similar seasonality of flows in the reach below the Narrows, but significantly improve conditions compared to the No Project. It has the poorest performance of the reservoir alternatives for maintaining juvenile rearing habitat.

Near Carmel to the Narrows: Compared to natural flow conditions, operation of the 15,000 AF reservoir would slightly reduce the percentage of years when the lower river would dry up from 44 to 41 percent (Table 8-11). This would be a beneficial impact.

Narrows to San Clemente Dam: Operation of 15 CAN/D would reduce the average minimum summer flow at the Narrows from 3.2 cfs to 2.2 cfs (Figure 8-10). The reduced flow would provide 1.1 million rearing index units of age 0+ juvenile habitat in the reach between the Narrows and San Clemente Dam, or a 20 percent reduction in habitat as compared to the 1.4 million units with natural flows (Table 8-12). The project operation would reduce habitat for yearling steelhead from 0.40 to 0.25 million units, or a 36 percent decline. These changes would be significant impacts.

Between San Clemente and Los Padres Dam: The operation of 15 CAN/D would reduce the average minimum late spring and early summer flow below Los Padres Reservoir from 20.1 to 19.9 cfs (Figure

8-11). This change would increase habitat for steelhead fry from an average 284,000 WUA units to 301,000 units, or by 6 percent (Table 8-13). This would be a beneficial impact.

The operation of the 15,000 AF reservoir would increase the average late summer flow below Los Padres Dam from 2.4 to 5.3 cfs, which would increase habitat for juvenile steelhead from an average 62,000 WUA units to 143,000 WUA units, or a 131 percent increase (Table 8-13). This would be a beneficial impact.

Although no rearing habitat is inundated by the 15 CAN/D, it would produce the lowest quantity of rearing habitat of the reservoir alternatives due to its operations (Table 8-5).

Mitigation Measure 8.3.3-5

Because 15 CAN/D performs poorly downstream of San Clemente Dam in regard to summer habitat, the District would attempt to improve performance by modifying the operation schedule or changing project facilities. To mitigate impacts below the Narrows, the District would continue the program to rescue and rear juveniles that are isolated downstream of the Narrows. Based on the operation study, this program would be needed in 94 percent of the 33 simulated years and would operate an average of five months per year. Costs for this program would average $41,000 per year and range from $0 to $97,000 per year (Table 8-14). This program would mitigate adverse effects to a less than significant level.

Flows for Fall-Winter Downstream Migration

Impact 8.3.3-6

Compared to natural flows, the operation of the 15,000 AF Cañada Reservoir would significantly increase the risk that juvenile steelhead would be stranded in the Carmel River downstream of Robles del Rio, and would significantly reduce this risk compared to the No Project.

During the 19 years when a risk would occur (56 percent of years studied), the number of days with high risk would average 44 days per year (Table 8-15). Overall, this impact is considered to be significant.

Mitigation Measures 8.3.3-6

The Cañada Reservoir operation does not include any releases from storage to maintain flows in the lower river. The District would investigate whether the operation schedule or proposed facilities can be modified in ways to provide flows in the lower river following the downstream

migration of juveniles during fall or winter. If flows are insufficient, the District would continue the program to rescue fall-winter migrants that are stranded below Robles del Rio in all but the wettest years. Operating costs for the trapping and holding facilities would average $42,000 per year and range from $0 to $161,000 annually (Table 8-16). The impact on fall/winter migrants would be fully mitigated to a less than significant level.

Flows for Spring Emigration

Impact 8.3.3-7

Overall, the 15 CAN/D would adversely impact opportunities for smolt emigration by increasing the percentage of years with poor, critical or zero emigration conditions, reducing the percentage of years with good to excellent emigration conditions, and increasing the occurrence and duration of the risk of isolating smolts in the lower river.

Compared to simulated natural flows, the operation of the 15,000 AF Cañada Reservoir would significantly reduce opportunities for smolt emigration in below normal, dry and critical years. It would increase the percentage of years with poor, critical or zero ratings from 9 percent to 27 percent and reduce the percentage of years with good to excellent ratings (Table 8-17).

The 15 CAN/D would increase the risk that steelhead smolts would be isolated by low flows during April and May and would increase the severity of the risk. The incidence of risk would increase from 26 percent to 59 percent of the record, and the average number of days with risk would increase from 20 to 35 days per year (Table 8-18). These would be significant impacts.

Mitigation Measure 8.3.3-7

The Cañada Reservoir operation does not include any releases from storage to maintain flows in the lower river. The District would investigate whether the operation schedule or proposed facilities can be modified in ways to provide flows in the lower river during spring. If this is not feasible, the District would continue the program for trapping and transporting smolts during some above normal years and all below normal, dry and critical years. Operating costs would average $34,000 per year and range from $0 to $94,000 annually (Table 8-19). Impacts to spring migrants would be mitigated to a less than significant level.

IMPACTS ON FISH PASSAGE

Impact 8.3.3-8

The Cañada Dam alone would not impair fish migration. However, operation of existing facilities at both dams on the Carmel River (which are part of this project) may result in

a significant impact to the steelhead population. Winter migrants would be delayed at both dams for two to three weeks in most years; smolt emigration would be partially blocked in spring during most years. This would result in low returns of sea-run adults to the river above San Clemente Dam.

Upstream Passage at Los Padres Dam. With the 15 CAN/D, the existing facilities at Los Padres Dam may be operated to collect and transport adults upstream. As noted in Section 8.1.5.2, the existing facilities may impact adults as a result of stress caused by crowding in the small holding pool, by netting, and by crowding and high temperatures during transport. The impacts may be similar to the No Project, depending on whether the CDFG requires additional changes to the facilities and represents a significant impact as compared to natural conditions.

Downstream Passage at Los Padres Dam. Juvenile and adult steelhead may continue to emigrate downstream by swimming through the existing reservoir and spillway. As described in Section 8.1.5.2, the existing facilities injure and cause mortalities at low to moderate flows. Currently, the CDF&G and NMFS are developing plans to improve passage conditions at Los Padres Dam. Depending on the design and operation of facilities, the impacts could be reduced, but probably not fully mitigated without great expense. Because of these unknowns, impacts associated with the facilities represent potentially, avoidable significant impacts.

Operation of the system with the 15 CAN/D alternative would delay the fall/winter downstream migration of juveniles past the existing Los Padres Dam an average of 18 days, as compared to natural conditions and would slightly increase the delay from 15 to 18 days, as compared to the No Project (Table 8-20). These represent significant impacts.

Downstream Passage at San Clemente Dam. Passage of migrating juvenile steelhead with the 15 CAN/D would be delayed by an average of 24 days per year (Table 8-20). Delays would occur during most years. Smolts could emigrate only 29 percent of the days during April-May in critical years, and would be blocked during the remainder of the period (Table 8-23). This represents slightly better performance than the No Project, but an adverse impact compared to natural conditions.

Mitigation Measure 8.3.3-8

With 15 CAN/D, major additions and modifications would be needed to reduce injury and mortality at Los Padres Reservoir. It is unlikely that improvements would result in less than

significant impacts to migrating steelhead, especially adult downstream migrants. At San Clemente, operations may be altered to reduce migration delays and blockages by maintaining reservoir storage at spillway levels at San Clemente Dam. Successful mitigation would reduce adverse impacts to migrating steelhead at Los Padres and San Clemente, but the impacts would be considered potentially avoidable, but significant.

PROJECT IMPACTS ON WATER TEMPERATURE

Impact 8.3.3-9

The 15 CAN/D would maintain water temperatures equivalent to the No Project conditions, and would result in less than significant impacts, except in critically dry years when the duration of cool-water releases would be increased.

The operation schedule for this project does not include streamflow releases into the Carmel River. Thus, flows and water temperatures would be similar to the No Project and result in average flows at the Narrows of about 2 cfs (see Figure 8-14).

Hypolimnetic Volume at Beginning of Summer. With 15 CAN/D, an average of about 500 AF of cool hypolimnetic water would be available for release at the beginning of the dry season. Cool water would be available in all years of the historical record (Table 8-24). This alternative would provide the same average volume of cool water as the No Project, and thus would have no impact.

Hypolimnetic Volume at End of Dry Season. With 15 CAN/D, an average of only 261 acre-feet of cool hypolimnetic water would be available for release at the end of the dry season, and the cool water would be exhausted in 11 years of the historical record (Table 8-25). These impacts would be similar to the No Project, and represent the poorest average performance of the reservoir projects.

Days with Hypolimnetic Releases. On average, the 15 CAN/D would provide cool water releases throughout the dry season of wet years. It could maintain cool water releases through 88 to 96 percent of the period during above and above normal years, 54 percent of the dry years and 49 percent of the critically years (Table 8-26). This would be a slight improvement over the No Project years, and represents a less than significant beneficial impact.

Mitigation Measure 8.3.3-9

The conceptual design of 15 CAN/D does not include any facilities or measures to control water temperature in the Carmel River. But with careful operation of existing, it should be possible operate with no significant impact to water temperatures.

SUMMARY OF 15,000 CAN/D IMPACTS ON STEELHEAD RESOURCE

Habitat Inundation. No spawning or rearing habitat would be inundated by the 15 CAN/D alternative. The net effect would be beneficial due to the altered flow patterns that would result from this alternative.

Operation Impacts on Steelhead Life Cycle. Compared to simulated natural conditions, the 15 CAN/D would result in significant adverse impacts to several facets of the steelhead life cycle, including upstream migration, spawning, the risk of stranding juveniles during summer, fall-winter downstream migration and spring smolt emigration. (There would be localized effects that are similar or beneficial compared to the existing situation.) All of these impacts could be reduced to a less than significant level with the Water Allocation Mitigation Program efforts described previously, with one exception: the impact to upstream migration would be an unavoidable significant impact because the 15 CAN/D entails no flow releases into the Carmel River. Mitigating these impacts to less than significant levels would require intensive rescue, rearing, and transport activities in the lower Carmel River. Since Cañada operations do not include augmentation of streamflow in the lower river, it may be impossible to avoid intensive rescue efforts similar to existing conditions.

Fish Passage and Water Temperature. The 15 CAN/D operation would adversely affect fish passage, compared to natural conditions. Conditions would be similar or slightly improved compared to the existing situation, but may still produce migration delays due to lack of flow and inadequate facilities at Los Padres Dam. All adverse impacts could be mitigated with improvements to facilities, but probably not to a less than significant level.

The temperature regime would be similar to the No Project alternative situation.

8.3.4 7 MGD DESALINATION PROJECT (7 DSL)

INUNDATION AND BLOCKAGE OF SPAWNING HABITAT

Impact 8.3.4-1

The desalination alternative would not inundate or block spawning habitat in the Carmel Basin.

Mitigation Measure 8.3.4-1

No mitigation measures would be required. However, the habitat losses that would occur due to the diversion at San Clemente Dam with this alternative could be mitigated by restoring spawning habitat below the existing dams. If implemented, such a program would result in a beneficial impact as compared to the existing situation.

INUNDATION AND BLOCKAGE OF REARING HABITAT

Impact 8.3.4-2

The 7 DSL alternative would not inundate or block rearing habitat in the Carmel River Basin.

Mitigation Measure 8.3.4-2

No mitigation measures would be required. The project operations maintain habitat at about the same level as the existing situation (Table 8-5), but at a level greater than the natural flow conditions. Thus, the overall impact would be beneficial.

IMPACTS OF PROJECT OPERATION

Though the 7 DSL project would not directly store or divert water from the Carmel River or its tributaries, it must be operated in conjunction with existing reservoirs and wells along the river in order to meet water demand. Thus the operation effects noted below are effects of the water supply system with the 7 DSL facilities in place.

Flows for Adult Upstream Migration

Impact 8.3.4-3

Overall, the operation of 7 DSL at buildout demand would significantly reduce opportunities for upstream migration by limiting the duration of attraction flows, shortening the duration of the migration season, and increasing the number of years without attraction flows.

At buildout demand levels, the 7 MGD Desalination Plant (7 DSL) would meet the modified CDFG seasonal criteria in 70 percent of the years and would achieve a "fair" or better rating with the DWK monthly criteria in 44 percent, 68 percent, and 71 percent of the Januaries, Februaries, and Marches, respectively (Table 8-6). As compared to simulated natural flows, the operation of 7 DSL would adversely impact upstream migration by reducing the percentage of years with flows exceeding CDFG criteria and by reducing opportunities for upstream migration during January, February, and March.

On average, the 7 DSL would provide 26 days of attraction flows (minimum flows ranging from 75 to 200 cfs), and would an average of two weeks of attraction flows in dry, below normal, above normal and wet years. (Table 8-7). However, it would provide an average of only one day in critically-dry years; in 24 percent of the years no attraction flows would occur. As compared to natural conditions, this alternative would significantly reduce attraction flows and would maintain attraction flows similar to the No Project.

On average, the duration of the migration season would be 45 days, which is about nine days shorter than under natural conditions and similar to the No Project (Table 8-8). Most of the impact would occur in below normal, dry and critical years, when the average duration would be reduced by 18 days during below normal and dry years, and 7 days during critical years. Overall, this impact would be considered significant.

Mitigation Measure 8.3.4-3

Implementation of mitigation described for 24 NLP under Mitigation Measure 8.3.1-3, would reduce the impacts on upstream migration, but not below a significant level. For this reason the impacts remains unavoidable and significant.

Flows for Steelhead Spawning Habitat

Impact 8.3.4-4

The operation of 7 DSL would have no impact on spawning habitat between San Clemente Reservoir and Los Padres Dam and significantly reduce spawning habitat downstream of San Clemente Dam by maintaining high diversions thru the Carmel Valley Filter Plant during February and March of below normal, dry and critical years. Overall, this represents a significant, adverse impact.

Downstream of San Clemente Dam: The operation of the 7 DSL would reduce average February flows by 12 to 13 cfs at the Narrows during February and March. These flow reductions would provide 14,700 units of WUA, which is equivalent to No Project conditions, but represents a significant, adverse reduction of 5 percent compared to Natural conditions (Table 8-9).

Between San Clemente and Los Padres Dams: Table 8-10 lists the total weighted useable spawning habitat area (WUA) between the dams during selected years of the 90-year record. During these years, operation of 7 DSL would maintain 8,100 units, equivalent to Natural conditions.

Mitigation Measure 8.3.4-4

The District would investigate whether flows could be improved by changing operations during February and March of below normal and dry years. If that is not sufficient, MPWMD could improve spawning habitat by implementing a program tc maintain spawning gravels upstream of the Narrows. Thus, the adverse impact would be reduced to a less than significant level.

Flows for Juvenile Rearing Habitat

Impact 8.3.4-5

The 7 DSL operation would increase steelhead fry and juvenile habitat in the reach between the dams, but would significantly reduce habitat in the reach between the Near Carmel gage and San Clemente Dam. It would significantly increase the seasonality of streamflow and stranded juveniles in the lower river more often than with natural flows. These impacts would be considered significant.

Near Carmel to the Narrows: Compared to natural flow conditions, operation of the 7 MGD desalination plant would increase the percentage of years when the lower river would dry up from 44 to 97 percent (Table 8-11). This would be a significant impact.

Narrows to San Clemente Dam: Operation of 7 DSL would reduce the average minimum summer flow at the Narrows from 3.2 cfs to 2.2 cfs (Figure 8-10). The reduced flow would provide 1.11 million rearing index units of age 0+ juvenile habitat in the reach between the Narrows and San Clemente Dam, or a 18 percent reduction in habitat as compared to the 1.36 million units with natural flows (Table 8-12). The project operation would reduce habitat for yearling steelhead from 0.39 to 0.25 million units, or a 36 percent decline. These changes would be significant impacts.

Between San Clemente and Los Padres Dams: The operation of 7 DSL would reduce the average minimum late spring and early summer flow below Los Padres Reservoir from 20.1 to 19.9 cfs (Figure 8-11). This change would increase habitat for steelhead fry from an average 284,000 WUA units to 301,000 units, or by 6 percent (Table 8-13). This would be a beneficial impact.

The operation of 7 DSL would increase the average late summer flow below NLP from 2.4 to 7.0 cfs, which would increase habitat for juvenile steelhead from an average 62,000 WUA units to 143,000 WUA units, or a 131 percent increase (Table 8-13). This would be a beneficial impact.

Mitigation Measure 8.3.4-5

To mitigate for impacts below Robles del Rio, the District would continue the program to rescue and rear juveniles that are isolated. Based on the operation study, this program would be needed in 97 percent of the 33 simulated years and would operate an average of seven months per year. Costs for this program would average $49,000 per year and range from $0 to $97,000 per year (Table 8-14). This program would mitigate impacts to a less than significant level.

Flows for Fall-Winter Downstream Migration

Impact 8.3.4-6

Compared to natural flows, the operation of a 7 MGD desalination plant would significantly increase the risk that juvenile steelhead would be stranded in the Carmel River downstream of Robles del Rio, and would maintain similar impacts as the No Project.

During the 33 years when a risk would occur (97 percent of years studied), the number of days with high risk would average 36 days per year (Table 8-15). Overall, this would be considered a significant impact.

Mitigation Measure 8.3.4-6

The District The District would continue existing programs to trap and hold fall/winter migrants that are stranded below Robles del Rio in all but the wettest years. Operating costs for the trapping and holding facilities would average $58,000 per year and range from $0 to $179,000 annually (Table 8-16). The impact on fall/winter migrants would be fully mitigated to a less than significant level.

Flows for Spring Emigration

Impact 8.3.4-7

Overall, the 7 DSL would adversely impact opportunities for smolt emigration by increasing the percentage of years with poor, critical or zero emigration conditions, reducing the percentage of years with good to excellent emigration conditions, and increasing the occurrence and duration of the risk of isolating smolts in the lower river.

Compared to simulated natural flows, the operation of the 7 MGD desalination alternative would significantly reduce opportunities for smolt emigration in below normal, dry and critical years. It would increase the percentage of years with poor, critical or zero ratings from 9 to 29 percent and reduce the percentage of years with good to excellent ratings (Table 8-17).

The 7 DSL would increase the risk that steelhead smolts would be isolated by low flows during April and May, and would increase the severity of the risk. The incidence of risk would increase from 26 to 65 percent of the record, and the average duration of risk would increase from 20 to 39 days per year (Table 8-18). These would be significant impacts.

Mitigation Measure 8.3.4-7

The District would continue the program for trapping and transporting smolts during some above normal years and all below normal, dry and critical years. Operating costs would average $41,000 per year and range from $0 to $94,000 annually (Table 8-19). Impacts to spring migrants would be mitigated to a less than significant level.

IMPACTS ON FISH PASSAGE

Impact 8.3.4-8

The 7 DSL would not impair fish migration. However, operation of existing facilities at both dams on the Carmel River (as part of this project) may result in a significant impact to the steelhead population. Winter migrants at San Clemente Dam would be delayed at

both dams for two to four weeks. Smolt emigration would be partially blocked in spring during most years. This may result in low returns of sea-run adults to the river above San Clemente Dam.

Upstream Passage at Los Padres Dam. The potentially adverse impacts of the 7 MGD desalination plant (7 DSL) would be the same as those for 15 CAN/D. As noted in Section 8.1.5.2, the facilities may impact adults. The impact may be similar to the No Project, depending on whether the CDF&G requires additional changes to the facilities, and represent a potentially significant impact as compared to natural conditions.

Downstream Passage at Los Padres Dam. Impacts with the 7 DSL alternative would be similar to those described for 15 CAN/D. Continued operation of the system under existing conditions will result in significant injury and mortality of juvenile steelhead. The problems could be mitigated, but probably not fully mitigated with great expense. Currently, those expenses are not part of this project. The impacts associated with the facilities represent potentially avoidable significant impacts. Operation of the system with the 7 DSL would delay the fall/winter downstream migration of juveniles past the existing Los Padres Dam an average of 19 days (Table 8-20). This represents a significant impact.

Downstream Passage at San Clemente Dam. Passage of migrating juvenile steelhead with the 7 DSL would be delayed an average of 25 days per year (Table 8-20). Delays would occur during most years. Smolts could emigrate only 32 percent of the time during April and May in critically-dry years, 70 percent in dry years, 82 percent in below normal years, and 94 to 100 percent in above normal or wet years. (Table 8-23). This performance is similar to the No Project, but is an adverse impact compared to natural conditions.

Mitigation Measure 8.3.4-9

Same mitigations as described 8.5.4-1 for 15 CAN/D under Mitigation Measure 8.3.3-8. Successful mitigation would reduce adverse impacts to migrating steelhead at Los Padres and San Clemente, but the impacts would be considered potentially avoidable, but significant impact.

PROJECT IMPACTS ON WATER TEMPERATURE

Impact 8.3.4-9

Same impacts as described for 15 CAN/D under Mitigation Measure 8.3.3-9. Water temperatures would be equivalent to the No Project condition.

The operation schedule for this project does not include additional streamflow releases into the Carmel River and water temperatures would be similar to the No Project.

Hypolimnetic Volume at Beginning of Summer. The 7 DSL alternative would provide the same average volume (486 AF) of cool water as the No Project (Table 8-24).

Hypolimnetic Volume at End of Dry Season. The 7 DSL alternative would provide the same average volume (261 AF) of cool water as the No Project (Table 8-25).

Days with Hypolimnetic Releases. The 7 DSL alternative would provide the same duration of cool water releases as the No Project (Table 8-26).

Mitigation Measure 8.3.4-9

The 7 DSL alternative does not include any facilities or measures to control water temperature in the Carmel River. The level of significance for impacts does not warrant the addition of any new facilities.

SUMMARY OF 7 DSL IMPACTS ON STEELHEAD RESOURCE

Impacts and mitigations with the 7 DSL alternative would be similar to those described for the 15 CAN/D alternative.

8.3.5 NO PROJECT ALTERNATIVE (NO PRJ)

INUNDATION AND BLOCKAGE OF SPAWNING HABITAT (NO PRJ)

Impact 8.3.5-1

The No Project alternative would not inundate or block spawning habitat in the Carmel River Basin.

In terms of direct impacts, the No Project alternative would not inundate or block any spawning habitat in the Carmel River Basin. However, due to inadequate passage facilities at the existing Los Padres Dam, the spawning habitat upstream of the dam would be under-utilized until the facilities are improved.

Mitigation Measure 8.3.5-1

No mitigation measures would be required. However, the habitat losses that would occur due to the existing diversion at San Clemente Dam could be mitigated by restoring spawning habitat below the existing dams. If implemented, such a program would result in a beneficial impact compared to the existing situation.

INUNDATION AND BLOCKAGE OF REARING HABITAT

Impact 8.3.5-2

The No Project alternative would not inundate or block rearing habitat in the Carmel River Basin.

Mitigation Measure 8.3.5-2

No mitigation measures would be required. The project operations would provide more rearing habitat than with natural flow conditions. Thus, the overall impact would be beneficial.

IMPACTS OF PROJECT OPERATION

The No Project alternative differs substantially from the other alternatives as demand is limited to 17,359 AF Cal-Am annual production, not the 22,750 AF annual buildout demand.

Flows for Adult Upstream Migration

Impact 8.3.5-3

Overall, the operation of the No Project alternative would significantly reduce opportunities for upstream migration by limiting the duration of attraction flows, shortening the duration of the migration season, and increasing the number of years without attraction flows, when compared to natural conditions.

At demand limited to 17,359 AF, the No Project would meet the modified CDFG criteria in 69 percent of the years and would achieve a "fair" or better rating with the DWK monthly criteria in 41, 67, and 71 percent of the Januaries, Februaries, and Marches, respectively (Table 8-6). As compared

to natural flows, the No Project would adversely impact upstream migration by reducing the percentage of years with flows exceeding CDFG criteria and by reducing opportunities for upstream migration during January, February, and March.

On average, the No Project would provide 26 days of attraction flows (minimum flows ranging from 75 to 200 cfs), and provide about two weeks of attraction flows during wet, above normal and below normal years, (Table 8-7). However, it would provide an average of only one day in critical years; in 15 percent of the years no attraction flows would occur. As compared to natural conditions, the No Project would significantly reduce attraction flows, and the reduction is similar to the other alternatives.

On average, the duration of the migration season would be 45 days, which is about nine days less than natural conditions (Table 8-8). Most of the impact would occur in below normal, dry and critical years, when the average duration would be reduced by 15 days during below normal years, 16 days during dry years and 10 days during critical years. Overall, this would be considered a significant impact.

Mitigation Measure 8.3.5-3

No mitigation is available for this alternative that would reduce impacts to a less than significant level. Thus, this would remain an unavoidable significant impact. A similar finding was made as part of the Water Allocation Program Final EIR certification.

Flows for Steelhead Spawning Habitat

Impact 8.3.5-4

Same impacts as described for 7 DSL alternative under Mitigation Measure 8.3.4-4. Operation of the No Project alternative would significantly reduce spawning habitat downstream of San Clemente Dam by maintaining high diversions through the Carmel Valley Filter Plant during February and March of below normal, dry and critical years.

Downstream of San Clemente Dam: The operation of the No Project would reduce average flows by 12 cfs during February and March.. These flow reductions would provide 14,700 units of WUA, which represents a significant adverse reduction of 5 percent compared to Natural flow conditions (Table 8-9).

Between San Clemente and Los Padres Dams: Table 8-10 lists the total weighted useable spawning habitat area (WUA) between San Clemente Reservoir during selected years of the 90-year record. During the selected years, operation of the No Project would an average of 8,100 units of WUA, equivalent to habitat under natural flow conditions and representing no impact.

Mitigation Measure 8.3.5-4

Operation of 7 DSL would reduce spawning habitat in the river upstream of the Narrows. The District would investigate whether flows could be improved by changing operations during February and March of below normal and dry years. If that is not sufficient, MPWMD would could improve spawning habitat by implementing a program to maintain spawning gravels upstream of the Narrows. Thus, the adverse impact would be reduced to a less than significant level.

Flows for Juvenile Rearing Habitat

Impact 8.3.5-5

Compared to natural flow conditions, the No Project operation would increase steelhead fry and juvenile habitat in the reach between the dams, but would significantly reduce habitat downstream of San Clemente Dam. It would increase the seasonality of streamflow and the stranding of juveniles in the lower river more often than with natural flows.

Near Carmel to the Narrows: Compared to natural flow conditions, operation of the No Project would increase the percentage of years when the lower river would dry up from 44 to 97 percent (Table 8-11). This would be a significant impact.

Narrows to San Clemente Dam: Operation of the No Project would reduce the average minimum summer flow at the Narrows from 3.2 cfs to 2.4 cfs (Figure 8-10). The reduced flow would provide 1.11 million rearing index units of age 0+ juvenile habitat in the reach between the Narrows and San Clemente Dam, or a 18 percent reduction in habitat as compared to the 1.36 million units with natural flows (Table 8-12). The project operation would reduce habitat for yearling steelhead from 0.39 to 0.25 million units, or a 36 percent decline. These changes would be significant impacts.

Between San Clemente and Los Padres Dams: The operation of the No Project would reduce the average minimum late spring and early summer flow below Los Padres Reservoir from 20.1 to 19.9 cfs, and (Figure 8-11). This flow would increase habitat steelhead fry from an average of 284,000 WUA units to 301,000 WUA units, a six percent increase (Table 8-13).

The operation of the No Project would increase the average late summer flow below Los Padres Dam from 2.4 to 5.3 cfs, which would increase habitat for juvenile steelhead from an average of 62,000 WUA units to 143,000 WUA units, or by 131 percent (Table 8-13). This would be a beneficial impact.

Mitigation Measure 8.3.5-5

For impacts downstream of San Clemente Dam, the District would attempt to improve summer flows by modifying operations. If flows are insufficient, the District would continue the program to rescue and rear juveniles that are isolated downstream of Robles del Rio. Based on the operation study, this program would be needed in 97 percent of the 33 simulated years and would operate an average of six months per year. Costs for this program would average $49,000 per year and range from $0 to $97,000 per year (Table 8-14). Impacts would be reduced to a less than significant level.

Flows for Fall-Winter Downstream Migration

Impact 8.3.5-6

Compared to natural flows, the No Project would significantly increase the risk that juvenile steelhead would be stranded in the Carmel River downstream of Robles del Rio. During the 33 years when a risk would occur (97 percent of the years studied), an average of 52 days per year would have high risk (Table 8-15).

Mitigation Measure 8.3.5-6

The District would attempt to increase flows with a different operation schedule, but options would be limited. If flows remained insufficient, the District would continue the existing program to rescue migrants in fall in all but the wettest years. Operating costs for the trapping and holding facilities would average $64,000 per year and range from $0 to $179,000 annually (Table 8-16). The impact on fall/winter migrants would be fully mitigated to a less than significant level.

Flows for Spring Emigration

Impact 8.3.5-7

The No Project would adversely impact opportunities for smolt emigration by increasing the percentage of years with poor, critical or zero emigration conditions, reducing the percentage of years with good to excellent emigration conditions, and increasing the occurrence and duration of the risk of isolating smolts in the lower river.

Compared to natural flows, the No Project would significantly reduce opportunities for smolt emigration in below normal, dry and critical years. It would increase the percentage of years with poor, critical or zero ratings from 9 to 30 percent, and would reduce the percentage of years with good to excellent ratings (Table 8-17).

The No Project maintains the existing high risk that steelhead smolts would be isolated by low flows during April and May. As compared to the natural conditions, the incidence of risk would increase from 26 to 65 percent of the record, and the average number of days with risk would increase from 20 to 40 days per year (Table 8-18). These would be significant impacts. This alternative has the worst performance for smolt emigration flows.

Mitigation Measure 8.3.5-7

The District would continue its existing program for trapping and transporting smolts in some above normal years and all below normal, dry and critical years. Operating costs would average $42,000 per year and range from $0 to $94,000 annually (Table 8-19). Impacts to spring migrants would be fully mitigated to a less than significant level.

IMPACTS ON FISH PASSAGE

Impact 8.3.5-8

The No Project alternative alone would not impair fish migration. However, operation of existing facilities at both dams on the Carmel River (which are part of this project) may result in a significant impact to the steelhead population. Winter migrants at San Clemente Dam would be delayed at both dams for three to four weeks in most years. Smolt emigration would be partially blocked in spring during most years. This may result in low returns of sea-run adults to the river above San Clemente Dam.

Upstream Passage at Los Padres Dam. The potentially adverse impacts associated with the No Project alternative would be the same as those for the 15 CAN/D and 7 DSL. As noted in Section 8.1.5.2, the existing facilities may impact adults as a result of stress caused by crowding in the small holding pool, by netting, and by crowding during transport.

Downstream Passage at Los Padres Dam. Impacts associated with the No Project alternative would be similar to those for 15 CAN/D and 7 DSL, except that the delay in migration would average 15 days per year. This would be a significant impact compared to natural conditions (Table 8-20). As outlined in Section 8.1.5.2, experiments conducted by the MPWMD indicates that emigrating juvenile

steelhead are injured and mortality averages about 20 percent, as the smolts pass thru the spillway and onto bedrock below the lip of the spillway. With the No Project, juvenile and adult steelhead may continue to emigrated downstream by swimming thru the existing reservoir and spillway. Currently, CDFG and NMFS are developing plans to improve downstream passage conditions at Los Padres Dam. Depending on the design and operation of new facilities, the impacts could be substantially reduced, but probably not fully mitigated, with great expense. Because of these unknowns, impacts associated with the No Project represent potentially, avoidable significant impacts.

Downstream Passage at San Clemente Dam. Impacts associated with the No Project alternative would be similar to those with 15 CAN/D and 7 DSL, except that the delay in passage of migrating juvenile steelhead would average 27 days per year (Table 8-20). Smolt passage would be delayed or blocked during most years. Smolts could emigrate only 16 percent of the days during April thru May in critical years, 73 percent in dry years, 84 percent in below normal years, and 94 percent in above normal and wet years (Table 8-23). These are significant adverse impacts compared to natural conditions.

Mitigation Measure 8.3.5-8

With the No Project, major additions and modifications would be needed to reduce injury and mortality at Los Padres Reservoir. It is unlikely that improvements would result in less than significant impacts to migrating steelhead, especially adult downstream migrants. At San Clemente, operations may be altered to reduce migration delays and blockages by maintaining reservoir storage at spillway levels at San Clemente Dam. Successful mitigation would reduce adverse impacts to migrating steelhead at Los Padres and San Clemente, but the impacts would be considered potentially avoidable, but significant.

PROJECT IMPACTS ON WATER TEMPERATURE

Impact 8.3.5-9

The No Project alternative would result slightly higher temperatures than under existing conditions, because less cool-water will be available after Los Padres fills with additional sediment.

The operation schedule for the No Project includes the existing schedule of streamflow releases into the Carmel River (see Section 4.10.3).

Hypolimnetic Volume at Beginning of Summer. The No Project alternative would provide 486 AF of cool water at the beginning of the summer (Table 8-24).

Hypolimnetic Volume at End of Dry Season. The No Project alternative would provide 261 AF of cool water at the end of the dry season, and run out of cool water in 11 years of the historical record (Table 8-25).

Days with Hypolimnetic Releases. On average, the No Project alternative would run out of cool water during a all but the wet years, and would do so sooner in critical and dry years (Table 8-26). This would be considered as a significant impact.

Mitigation Measure 8.3.5-9

The No Project alternative does not include any facilities or measures to control water temperature in the Carmel River. Impacts would probably be similar to, but more detrimental than, existing conditions. Due to the small size of the existing reservoirs, this is an unavoidable significant impact.

SUMMARY OF NO PROJECT IMPACTS ON STEELHEAD RESOURCE

Impacts and mitigations with the No Project alternative would be similar to the 15 CAN/D alternative.

8.4 CONSTRUCTION IMPACTS AND MITIGATION MEASURES

This section describes the potential impacts of construction activities on aquatic habitat and steelhead migration, and the measures the District would take to mitigate those impacts. Cost estimates for construction impact mitigations are not yet available at this level of analysis.

8.4.1 24,000 AF NEW LOS PADRES RESERVOIR (24 NLP)

Impact 8.4.1-1

Construction activities for the 24 NLP could impact steelhead migration, and could damage habitat due to sedimentation.

The construction of temporary diversion works and the base of the new dam could adversely impact the migration of adult steelhead during the period from January through mid-May. During their

upstream migration, adults may not be able to negotiate the diversion tunnel when water velocity exceeds 5 to 6 ft/s during storm events.

Construction activities associated with the temporary diversion works, the base of the new dam, removal of vegetation in the inundation zone, new roads, and borrow areas would increase the transport and deposition of fine sediment in the mainstem of the Carmel River downstream of the construction zone. If left unmitigated, the sediment would damage habitat for most aquatic species in the river.

Despite the mitigation measures instituted to prevent damage by the normal increase in sediment transport, there is a risk that catastrophic levels of erosion could occur following extremely high flows associated with unusual storms. Whether such a storm event would occur during the construction phase cannot be predicted. Without mitigation, these impacts would be considered significant.

Mitigation Measure 8.4.1-1

To mitigate for construction impacts of the 24,000 NLP project, the District would:

a) *construct and operate the upstream and downstream migration facilities to avoid interfering with the migration of adult and juvenile steelhead while the dam is constructed;*

b) *construct and operate temporary sediment traps in the Carmel River to avoid the impacts of soil erosion, transport of sand and silt, and sedimentation of habitat downstream of the project area; and*

c) *establish an emergency fund of $250,000 to cover the cost of cleaning up accidental discharges of sediment that substantially impair spawning and rearing habitat.*

These actions would reduce the potential impacts to a less than significant level.

8.4.2 24,000 AF NEW LOS PADRES RESERVOIR WITH 3 MGD DESALINATION PLANT (24 NLP/D)

The impacts and mitigation measures would be the same as those described in Section 8.8.1 for the 24 NLP alternative.

8.4.3 15,000 AF CAÑADA RESERVOIR WITH 3 MGD DESALINATION PLANT (15 CAN/D)

Depending on which option is used to divert flow from the Carmel River, construction activities could interfere with upstream migration of adult steelhead and downstream migration of juvenile steelhead. Sediment impacts and mitigations would be the same as described in Section 8.8.1, except the sediment traps would be located in the unnamed canyon below the proposed dam.

8.4.4 7 MGD DESALINATION PLANT (7 DSL) AND NO PROJECT (NO PRJ)

Construction activities with these alternatives are not expected to impact the steelhead resource in the Carmel River. Thus, no mitigation for project construction is anticipated in the Carmel River Basin.

8.5 DESALINATION ALTERNATIVES - IMPACTS TO MARINE RESOURCES

This section describes the effects of the desalination brine discharge on marine resources for the desalination project alternatives, and the measures available to mitigate identified impacts.

8.5.1 SETTING

Monterey Bay

Monterey Bay is California's second largest bay, approximately 23 miles long with a maximum width of 10 miles and covering an area of 212 square miles. The Bay is primarily shallow, with 82 percent of the area shallower than 330 feet and only 5 percent deeper than 1,300 feet.[30] Its most important geologic feature, the Monterey Submarine Canyon, bisects the Bay into generally equal northern and southern sectors. The canyon is the largest on the west coast of North America, equivalent in size to the Grand Canyon, having a volume of about 100 cubic miles and a maximum depth of about 10,000 feet.[31] It is generally believed to be part of the former drainage of the great valley of California.[32] Topographic influences of the Monterey Submarine Canyon result in a strong seasonal upwelling of nutrient-rich waters and modification of prevailing currents to produce a diversity of rich nearshore and pelagic habitats. Consequently, Monterey Bay is highly productive with rich and abundant floral and faunal communities.[33]

The area supports one of the greatest diversities of marine mammals in the world including whales, pinnipeds (seals and sea lions) and sea otters. Ninety-four seabird species are known to occur in the

Bay, of which about 30 species predominate. Most occur as visitors and spring/autumn migrants; however, 13 species are resident breeders, including Brandt's cormorants, western gulls, and pigeon guillemots.[34]

Species richness and diversity is the hallmark for invertebrate fauna and marine algae, with over 450 species described.[35] It is suspected that the Monterey Bay region has the richest and most diverse limpet and chiton fauna in the world.[36]

The diverse habitats of Monterey Bay each have their own characteristic assemblages of fish. Although the fish fauna of the Bay are relatively well known, fish in the submarine canyon are not.[37] However, the proximity of the canyon to shore occasionally allows rare or unrecorded deep-sea fishes to be taken by fisherman. Commercially important schooling fish such as herring and sardines, and their predators (sharks, king salmon, sablefish) inhabit the nearshore environment. The sablefish spawn in the deep waters of the canyon, but live in relatively shallow waters as juveniles.[38] Rocky reefs in the bay support many important rockfish species. Finfish such as greenling and lingcod are found in the kelp communities where the protection of the kelp canopy also provides a refuge for a host of pelagic and demersal species.[39]

Phytoplankton (microscopic plants suspended in seawater) are the basis upon which the food web of all marine systems depend. Zooplankton (tiny grazing animals in the water column), including copepods and euphausiids, feed upon the phytoplankton and, in turn, provide food for fish, whales and sea birds.[40] The plankton in Monterey Bay are primarily of the cold water type, but a few warm water species occur.[41] Diatoms comprise the major component of the phytoplankton. Primary productivity, a measure of the amount of phytoplankton, exhibits seasonal fluctuations with peaks during spring and summer, when upwelling supplies nutrient-rich waters to the coastal areas.

Twenty-six species of marine mammals frequent the Monterey Bay area, including the Southern sea otter, five species of seals and sea lions, and twenty species of cetaceans (whales and dolphins). Of these, the sea otter, Stellar's sea lion, Guadelupe fur seal, and gray, fin, blue, humpback and sperm whales are classified as endangered or threatened, and subject to protection (see Table 8-27).

TABLE 8-27

THREATENED AND ENDANGERED MARINE SPECIES OF MONTEREY BAY

Mammals		Status
Southern sea otter	*Enhydra lutris nereis*	FT
Stellar's sea lion	*Eumetopisa jubata*	FT
Guadelupe fur seal	*Arctocephalus townsendi*	FT
Gray whale	*Eschrichtius robustus*	FE
Fin whale	*Baleonoptera physalus*	FE
Blue whale	*Baleonoptera physalus*	FE
Humpback whale	*Megaptera novaengliae*	FE
Sperm whale	*Physeter catodon*	FE
Birds		
California brown pelican	*Pelecanus occidentalis californicus*	SE, FE

FT= Federally listed Threatened; FE= Federally listed Endangered; SE= State listed Endangered.

Source: California Department of Fish and Game, U. S. Fish and Wildlife Service, and National Marine Fisheries Service

Approximately 600 Southern sea otters exist in the nearshore waters from Ano Nuevo to Point Sur, including Monterey Bay. They commonly inhabit rocky coasts and kelp beds rather than the sandy bottom habitats common within Monterey Bay; however, small concentrations have been sited in Moss Landing Harbor and at the mouth of Elkhorn Slough.[42]

In central Monterey Bay, the presence of Stellar's sea lion and Guadelupe seals, along with that of whales (except the California gray whale) is likely to be rare and transient as they move through the area on the way to breeding or resting areas. California gray whales migrate twice annually through the nearshore waters en route to their Arctic feeding grounds or calving lagoons in Baja California. Southbound migrations occur between November and January, and northbound, February through May.

One final endangered species found in Monterey Bay is the California Brown Pelican. They migrate into the Bay from southern waters during September and October, and occupy roosting sites in Elkhorn Slough.[43] Pelicans generally feed offshore on schooling fish such as sardines, herring and anchovies.

Monterey Bay has recently been designated a National Marine Sanctuary. The primary goals of this designation are to facilitate long-term management and protection of its resources. Management objectives include the promulgation of regulations covering, among other things, discharges into the Bay. Consequently, discharges from the proposed desalination plant could become a management issue.

8.5.2 STANDARDS OF SIGNIFICANCE

For this project, a significant impact to the marine community would occur if the brine discharge were to adversely affect endangered or threatened species, or important commercial and recreational marine species.

8.5.3 IMPACTS OF THE 3 MGD DESALINATION PLANT

This section describes the impacts of the brine discharge from the 3 MGD desalination plant at Sand City. This information is applicable to the 24 NLP/D, 15 CAN/D, and 7 DSL alternatives.

A baseline survey was conducted by ABA consultants to evaluate the biotic resources of the subtidal zone in the vicinity of the proposed brine discharge zone.[44] The following discussion summarizes the methods and findings of this survey.

Survey Methods

The proposed Sand City discharge site is a wave-swept sandflat characteristic of the central portion of Monterey Bay. A preliminary baseline survey was conducted to provide quantitative data on the species composition and abundance of sediment-dwelling (benthic) organisms at the site, qualitative descriptions of the sand-bottom habitat, and observations on sediment structure.

The survey stations were positioned to fall within the predicted zone of maximum impact from brine discharge, and were arranged to fall along transects, or lines, within and adjacent to this maximum impact zone. Fifteen stations in the subtidal sediments were sampled by divers on August 27, 1992. The stations were distributed along three depth contours, corresponding to 5, 10 and 20 feet below mean lower low water (MLLW). On each depth contour, a grid of five transects was randomly placed over an 800 foot distance going north from the end of Tioga Road, Sand City, California. At each station, divers collected four replicate infaunal cores with a surface area of .018 m^2/core. Cores were pushed into the sediment approximately 14 cm, then carefully capped before bringing them to the surface. A separate sample for sediment grain size analysis was taken concurrently.

Results

Abundances of all species were low throughout the survey in comparison to other types of marine environments. The greatest species diversity and numbers generally occurred in the 20 feet depth stations. Exceptions were the olive snails (*Olivella picna* and *O. biplicata*) found primarily at ten feet with densities of 240/m^2, and the mole crab (*Emerita analoga*) found in greatest abundance at the five feet stations at densities of nearly 100/m^2. Twenty of 21 represented species occurred at the 20 feet depth. This compares with ten species at the ten foot depth, and only four species in the five foot depth stations. At the shallowest depth, three out of four species were represented solely by occurrences within a single station.

The sand dollar (*Dendraster excentricus*) exhibited by far the highest density of any species, with nearly 200 individuals/m^2. Approximately 20 to 30 percent of the individuals collected were small (< 1

cm) and a few (<5 percent) were the size of pin heads, indicating new recruits. However, it should be noted that in order to get representatives of the infauna, cores were deliberately taken in gaps in the sand dollar bed. Based on diver observations, *Dendraster* covered 90 to 95 percent of the bottom at the 20' station, with estimated densities of well over 1,000 individuals/m^2. At the 10 feet station they had almost disappeared, and they were not found at all at the shallow station.

Abundances of marine worms (*Glycera sp., Haploscolopus elongatus, Nephthys caecoides, Nemertean sp., Diospio uncinatus*) and two species of amphipods or small crustaceans (*Atylus tridens* and *Synchelidium shoemakeri*) were low throughout the 20 foot and ten foot stations and did not occur in the five foot stations (with the exception of the presence of *Atylus tridens* in transect #3 cores). The mole crab was bimodally distributed in the 20' and five foot stations and did not occur at ten feet. A single red rock crab (*Cancer antennarius*) with a carapace length of 3 cm, and a long egg-bearing hermit crab (*Pagarus* sp.) were found in transect #2 at 20 feet. The only bivalve species represented was the clam, *Tellina bodegensis*, found at the 20 foot stations.

Grain size analysis revealed an entirely sandy environment of gravel, coarse sand and medium to fine sand particles. The complete absence of a silt fraction indicates a high-energy environment where wave action affects the structure of the sediment throughout the sampling stations. Comparatively, the 20 foot stations exhibited the lowest energy environment. Here particles were well sorted (average sorting coefficient = 0.5) and overwhelmingly in the medium to fine sand size class (≥90 percent in all but one station). The least amount of gravel was found at this depth (about 2 percent) whereas the greatest percentage of gravel occurred in the ten foot stations (approximately 16 percent) indicating the highest energy regime of the three depth contours. Conversely, this depth had the least amount of the medium to fine sand fraction and exhibited the highest sorting coefficient, an indication of more poorly sorted sediments. The five foot stations closely tracked those of the twenty foot stations with a preponderance of medium to fine sand (average 81 percent) and about 6 percent gravel. However, sediments were somewhat more poorly sorted than those of the twenty foot stations.

Discussion

The benthic faunal survey and grain size analysis produced results consistent with observations from 20 years of research in Monterey Bay. The results are also consistent with published reports, although there is surprisingly little that has actually been published. Other studies on sandflats from

Monterey Bay either concentrate on the subtidal zone or the intertidal zone. Because of the difficulties inherent in working in the surf zone, little has been published from the shallow (<20 foot) subtidal. Based on survey observations, the Sand City location routinely has some of the highest surf in the interior bay.

The major biological feature of the Sand City sandflat is the well-developed sand dollar bed. Although their distribution has never been mapped, the sand dollar community is known to be present discontinuously throughout Monterey Bay in 20 to 35 foot depths. Because complete sampling of the sand dollar population requires a sampling technique different than we used for this preliminary survey, no quantitative information is available on the actual densities or size structure to the *Dendraster* community. However, the Sand City *Dendraster* bed is apparently not composed of full-sized adults, but instead appears to be composed almost exclusively of 2 to 3 year old and younger individuals. This may indicate that there are periodic catastrophic winter storm events that decimate the local population. There would then be heavy larval settlement the next spring, leading to a unimodal size class distribution. This hypothesis could be tested by long-term sampling that included size measurements.

Regardless of the low abundance and diversity of species in the potential impact zone, they represent the expected complement of organisms for the given environmental conditions. As such they function as a vital community well adapted to the high-energy environment, and play a role in the health of the near-shore ecosystem. With a few exceptions, the life histories and habitats of many of the species identified in this survey are vaguely, if at all, described or understood.

IMPACTS AND MITIGATION MEASURES FOR 3 MGD DESALINATION PLANT

Impact 8.5.3-1

Disposal of desalination brine via injection could adversely affect marine life in the vicinity of the brine discharge.

An experimental bioassay was conducted to obtain a preliminary indication as to the potential effects of injecting reject brine into the shallow coastal aquifer, for subsequent discharge to the near-shore ocean waters.[45] This bioassay subjected two benthic species (sand dollars and olive snails) to a range of elevated salinities. The test organisms were collected from the nearshore environment of Monterey Bay. The test organisms were then subjected to salinity levels of 33 (ambient), 38, 43 and

48 parts per thousand (ppt) for a period of 10 to 20 days. For more detail, please refer to Appendix 4B which contains a complete copy of the bioassay report.

The olive snail bioassay provided greater than 90 percent survival in all salinity levels, although the test was terminated after 10 days. The sand dollar bioassay yielded 100 percent survival after 20 days for salinity levels of up to 43 ppt, but at the highest salinity level (48 ppt) the test organisms showed signs of stress early on in the experiment and had zero survival after 10 days. While it is difficult to predict exactly how the proposed brine discharge would affect marine life, it can be concluded from these bioassays that young sand dollars cannot survive salinity levels of 48 ppt or greater.

It is also difficult to predict the exact behavior of the brine. Studies have shown that the coefficient of dispersion is on the order of 10 percent of the flow path, which in this case is estimated at 50 to 100 feet. The most likely estimate of the coefficient of dispersion is therefore five feet, which is still considered to be conservative. Assuming a coefficient of dispersion of five feet, modeling results indicate salinity levels of 46 ppt, 2.5 feet below the sea floor. This salinity level would decrease substantially as the brine migrated up the remaining distance to the sea floor, and would be diluted to background levels upon emerging from the sea floor into the high energy environment of the nearshore waters of Monterey Bay.

The nearshore waters of Monterey Bay in the vicinity of Sand City were confirmed to be a high energy environment during the course of the benthic survey. Benthic sampling was difficult due to the highly turbulent conditions, with the area encountering some of the highest surf in the interior bay. The grain size analysis of collected sediment samples revealed the complete absence of a silt fraction; the sediments consist solely of gravels and sands. This evidence of a highly turbulent environment was considered sufficient to assume that the partially diluted brine would be essentially completely diluted to background levels upon emerging from the ocean floor into this high energy environment.

The sand dollar community is considered to be quite common, both within Monterey Bay and in coastal waters from Alaska to Baja California. Additionally, because most species in the discharge area are relatively mobile, these creatures would probably move out of the area if conditions were to become physiologically stressful or otherwise undesirable. For these reasons, and because salinity levels are not expected to reach levels that would be fatal to the sand dollars, the discharge of brine

to the nearshore waters of Monterey Bay through injection wells is considered to have a less than significant impact to marine resources.

Mitigation Measure 8.5.3-1

None required; however, it is recommended that long-term monitoring of the marine community in the vicinity of the brine discharge zone be conducted to determine whether any substantial changes are occurring.

Impact 8.5.3-2

Discharge of pretreatment and cleaning substances could adversely affect marine life.

Any detergents, metals, acids, antiscalants or biocides used in pretreatment, or cleaning of the membranes, filters or pipes and discharged with the combined brine/effluent may be detrimental to marine organisms. However, with the exception of an antiscalant (polyacrylate, most likely FLO-CON® 100), no discharge of pretreatment and cleaning substances such as detergents, biocides and metals are proposed for this project. FLOCON 100 has been certified and approved for use in the preparation of potable water under National Sanitation Standard 60. Exposure to representative saltwater fish under EPA toxicological selection criteria indicated FLOCON 100 is not considered hazardous to aquatic animals or mammals. Because of the low toxicity of this substance and the high dilution of the reject brine, this impact is considered less than significant. However, in the case when full reclamation would occur and essentially undiluted brine were to be discharged from the MRWPCA outfall, there exists the potential for localized build-up over time of elevated concentrations in the sediments.[46]

If the proposed project operations are changed and chemicals other than FLOCON 100 are proposed for discharge with the reject brine, the effects of any such discharges would be evaluated as to their potential effects on marine life. Discharge of any additional substances would require a revision to any discharge permits issued, and the RWQCB would be responsible for enforcing permit conditions.

Mitigation Measure 8.5.3-2

None required or recommended.

8.5.4 IMPACTS OF 7 MGD DESALINATION PROJECT

This section describes the effects of the brine discharge for the 4 MGD desalination plant at the MRWPCA site near Marina. The impacts of the 3 MGD component at Sand City are described in Section 8.5.3.

Discussion

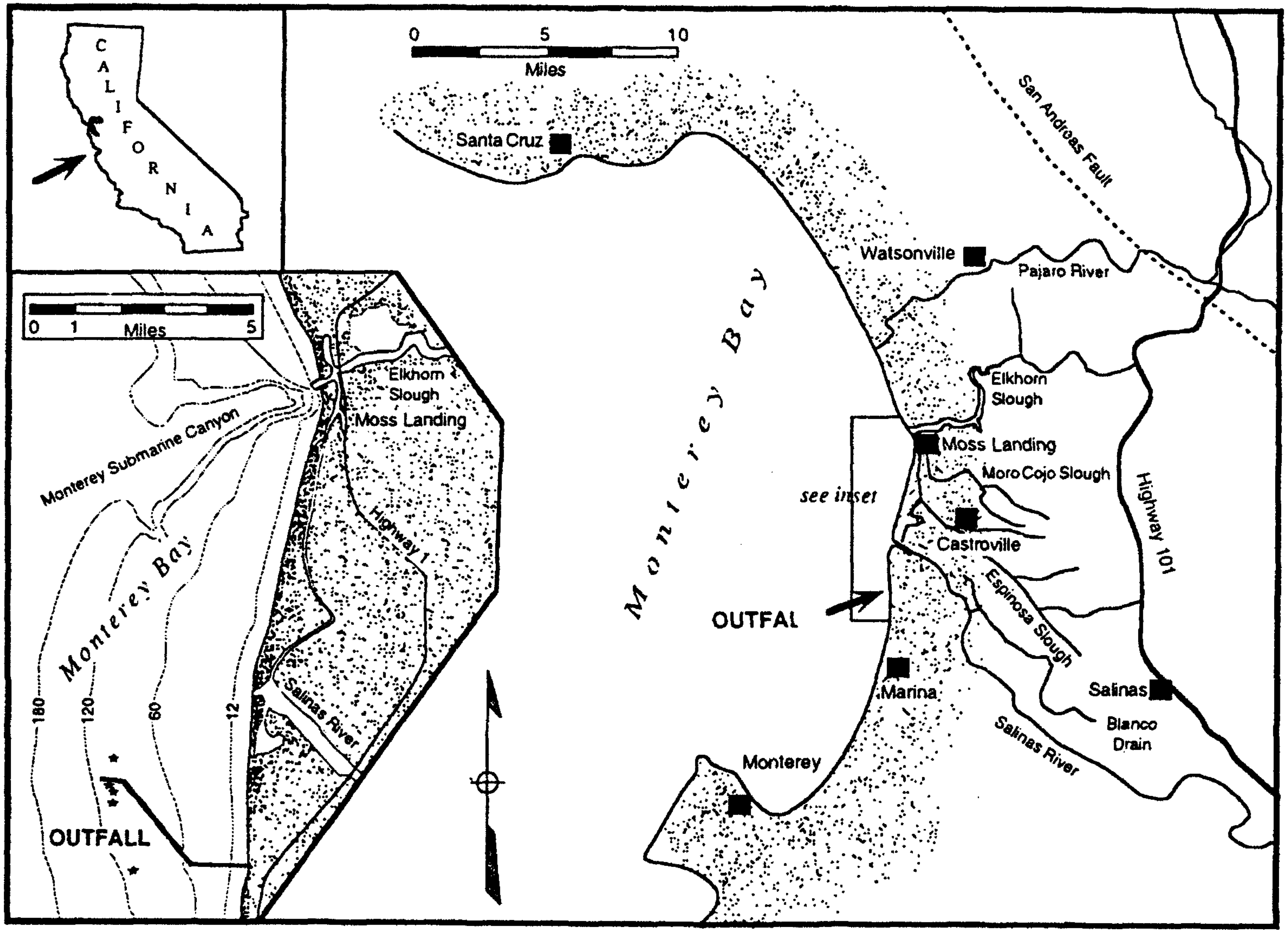
For the 4 MGD desalination plant, reject brine would be mixed with treated effluent and discharged through the existing MRWPCA outfall, a 1,368-foot long diffuser system. The outfall lies atop a bed of piled rocks several feet above the sea floor in about 100 feet of water in Central Monterey Bay. Figure 8-15 provides a location map of the MRWPCA outfall in Monterey Bay.

The direction and magnitude of currents and wave action would affect the dilution, mixing and dispersion of the discharge plume. Monterey Bay is fed cool subarctic water from the California Current. Coastal currents generally run parallel to shore, and the predominantly northerly circulation is weak, variable and subject to major reversals.[47] Estimated residence times for water replacement in the Bay is between two and 12 days. Salinities in the Bay tend to increase with depth, and values range between 33 and 36 parts per thousand (ppt).[48]

The proposed brine discharge is most likely to affect marine communities near the diffuser. Here, the sea floor is homogeneously sandy with ripple marks of varying periods, depending upon the degree of exposure to waves. The sandy bottom is broken only by the rock and pipe structure of the diffuser itself. The sediment consists of fine sand with little silt or organic particles, and grain sizes are relatively uniform indicating disturbance of the sediment by currents and waves.[49,50] Increased hydraulic scouring caused by water turbulence around the outfall encourages deposition of coarser sediment immediately beside it. It is within these coarser sediments that a tube-dwelling polychaete worm, *Diopatra ornata*, community has developed since the outfall was constructed in 1984.[51,52,53] This polychaete, or worm, constructs and lives within a protective parchment-type tube which projects 0.5 to 1 inch above the surface, and extends many yards into the sand (see Figure 8-16). Thousands of individuals may live in a three to six foot band alongside the diffuser, as shown in Figure 8-16. Species unable to thrive in the dynamic sandy-bottom habitat find refuge in the interstices of the polychaete tube mat. Here, the environment is more stable as the structure of

REGIONAL LOCATION MAP, MRWPCA OUTFALL

FIGURE 8-15



Bathymetric contours are in feet.
★ = location of long-term benthic monitoring stations

recycled paper

SOURCE: ABA CONSULTANTS

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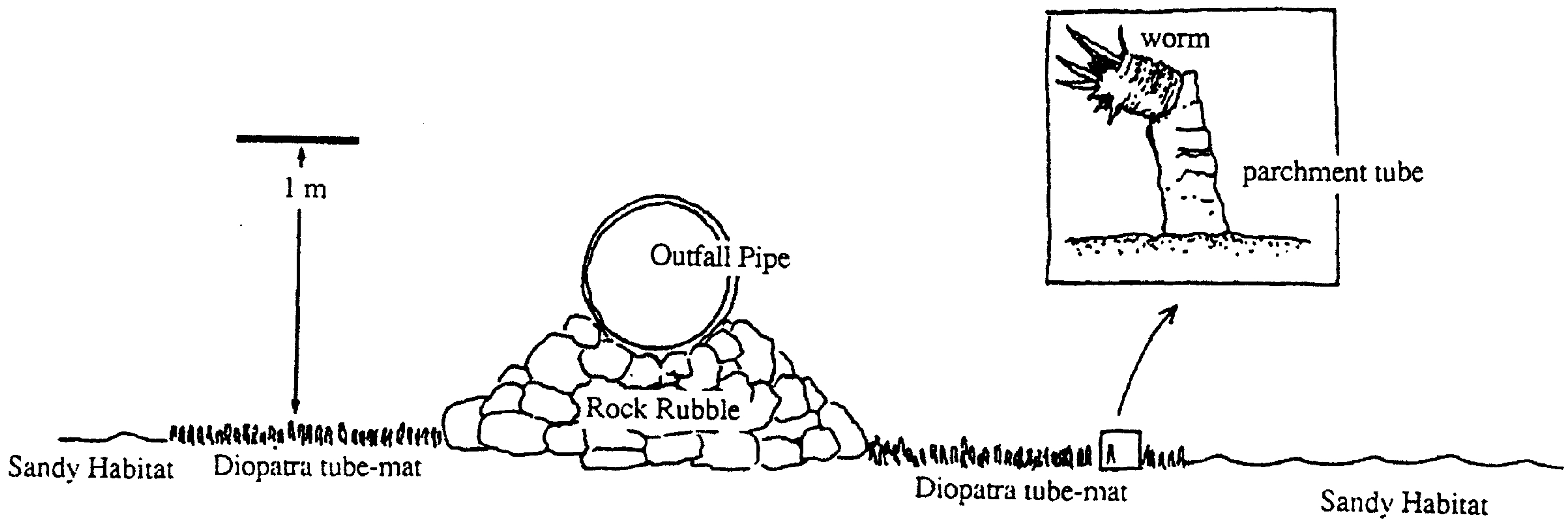
CROSS-SECTIONAL VIEW OF THE MRWPCA OUTFALL

FIGURE 8-16



SOURCE: ABA CONSULTANTS

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the tubes tends to dampen the action of waves and currents. Consequently, the tube-mat community defines the richest biological community in the area.[54]

The sea floor or "benthic" organisms have been characterized by monitoring studies of the receiving waters for the MRWPCA outfall.[55,56,57] There are two marine community types corresponding to the two habitats of sandy bottom and tube mat. Species composition of the tube-mat community differed greatly from that of the sand habitat away from the outfall, although crustaceans and polychaetes predominated in both environments. In the *Diopatra* tube-mat, other polychaete species included *Phragmatopoma* and *Magelona*. Tube-dwelling amphipods *Aoroides*, *Ischyrocerus*, *Photis* and epifaunal substrate dwellers, caprellid amphipods and crabs comprised the crustacean species. These species were virtually absent in the sandy habitat. Conversely, sand burrowing amphipods (e.g. *Rhepoxynius*) were dominant in sandy sites and rare in the tube mat. Some polychaete species were moderately abundant in both environments (e.g. *Prionospio* and *Armandia*).

The rocks and pipe of the outfall also provided a hard surface for colonization of several epifaunal species such as the sea stars, serpulid tube worms and anemones.[58] Additionally, the structure functions as an artificial reef and attracts a large number of rockfish and other reef fishes.[59] As a result, party and individual sport fishing boats concentrate their activity in the area.

A survey of fish prior to the installation of the MRWPCA outfall identified 46 species in the area.[60] From trawl catch data, the most abundant of these were the speckled sandab, English sole and the Pacific sandab. The nearshore subtidal habitats of Monterey Bay also support many commercially important species such as the northern anchovy, Pacific herring, sardine, King salmon, sablefish, sharks and rockfish.[61]

IMPACTS AND MITIGATION MEASURES FOR 4 MGD DESALINATION PLANT AT MRWPCA SITE

Impact 8.5.4-1

Disposal of reject brine could adversely affect marine life in the immediate vicinity of the MRWPCA outfall, if high levels of wastewater reclamation occur.

For the 4 MGD desalination plant, it is proposed that the reject brine be combined with treated effluent from the MRWPCA plant and discharged to Monterey Bay via the existing MRWPCA

outfall. It is likely that in the future a water reclamation plant will become operational, thus producing reclaimed water for subpotable uses, resulting in a corresponding reduction in the volume of treated effluent being discharged through the MRWPCA outfall. Depending upon the proportions of the brine/effluent blend, the discharge may be more saline than ambient seawater. Further information regarding the effects of this discharge on water quality is presented in Chapter 7, Hydrology and Water Quality, specifically under Impact 7.3.4-6.

Literature Review

The effects of brine discharge on marine organisms are not well documented. However, results from a study conducted at Key West, Florida, indicated combined temperature and salinity effects of effluent from a flash distillation desalination plant were small compared to observed seasonal changes in species composition and abundance.[62] There was a change in species composition immediately adjacent to the outfall, and certain fish species appeared to be attracted to the area, but it is unclear whether these effects were a result of changes in temperature or salinity.

Bioassay tests were conducted for a pilot plant desalination project for the Marin Municipal Water District to determine the effects of combined discharge of desalination process brine and treated secondary effluent. The species tested included larval inland silverside, *Menidia beryllina*; the diatom, *Skeletonema costatum*; blue mussel, *Mytilus edulis;* and the speckled sandab, *Citharichthys stigmaeus* Test results indicated that mortality associated with the combination of brine and secondary effluent may be due primarily to the secondary effluent.[63] However, chemical changes in the effluent caused by the addition of brine are not fully understood, particularly as they relate to biological impacts to organisms in the receiving waters.

Salinity Increase

An elevation of salinity could be harmful to marine organisms in the vicinity of the diffuser. Initial dilution analysis for the proposed 4 MGD desalination plant showed blended brine discharges would generally exceed the existing effluent initial dilution of 121:1 except when wastewater reclamation exceeds 85 percent. It is expected that 100 percent of the effluent will be reclaimed during summer months upon commencement of reclamation operations, with 100 percent year-round reclamation possible sometime in the future.

If no reclamation were to occur, the treated effluent would dilute the brine, while at the same time the brine would dilute the treated effluent; thus, no adverse impacts would occur to water quality or marine life. With 100 percent reclamation, essentially undiluted brine would be discharged through the outfall. In this case, the discharge plume would be more saline by approximately 3.5 percent, as compared to ambient seawater, and would be negatively buoyant; after initial dilution, the salinity of the plume would be about 35,800 mg/l (assuming an ambient salinity of 34,500 mg/l). In the model projection under the worst-case condition of no ambient current, the plume may settle on the ocean bottom. Benthic organisms sensitive to salinity changes may die or migrate out of the area. The ecological consequences of this scenario would likely be limited to the benthic environment immediately adjacent to the diffuser, and could result in the disappearance of organisms intolerant of salinity changes.

None of the marine species in the vicinity of the outfall are considered rare or endangered, and are in fact quite common. In addition, the tube-mat community that has developed in the vicinity of the outfall is an artifact of its construction. Therefore, because the adverse effects of brine discharge would be limited to the area immediately adjacent to the outfall, this impact would be considered less than significant.

Mitigation Measure 8.5.4-1

None required; however, it is recommended that the on-going monitoring of the MRWPCA outfall be continued, and the observation of the marine community near the outfall be considered in light of the desalination project.

Impact 8.5.4-2

Discharge of pretreatment and cleaning substances could adversely affect marine life.

Please refer to previous discussion on 3 MGD desalination plant in Impact 8.5.3-2.

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